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PRESIDENT MCKINLEY.

It has been pathetically interesting to electrical people to note how closely President McKinley came in touch last week with electricity in some one or other of its many manifestations. In the broad-minded speech which he made the day before the attempt to assassinate him, he alluded at some length to the great work of telegraphy and telephony in the transmission of intelligence, and he closed by saying: "The construction of a Pacific cable cannot be longer postponed." Then he saw and admired the lighting of the Pan-American that night. Next day he went to Niagara, where he found the Municipal Electricians in session, and visited the great power plant. A few hours later, struck down by the bullets of an assassin, he needed the cooling breath of the fan motor in his agony; and by long-distance telephone the best Röntgen ray outfit that could be secured had been ordered 500 miles away, to be in readiness to locate one of the bullets.

As Mr. McKinley remarked in his speech, "The same important news is read, though in different languages, the same day in all Christendom," but he little thought that the attempt on his life would be the next great event to which this would literally and exactly apply. It is by such inventions and innovations that much of the world's real advance comes, and it certainly never comes by any effort of anarchist or murderer. The Frenchman, Mitre, has asserted that the worst of governments is preferable to the best of revolutions, a phase which merely marks the extent of the recoil from the extreme atrocities of the Mountain and the Commune. But when all is said and done, the influence of the printing press, the telegraph, the steam engine, the trolley car and the telephone, if they could be fully determined would be found far more effectual in promoting the world's welfare than most political movements or all the revolutionary slaughter, directed to the same object.

ELECTRIC FOUNTAINS.

Once again we are indebted to Mr. Luther Stieringer for a very interesting article, and this week we publish a contribution from him, profusely illustrated, on the subject of electric fountains, supplementing the two previous articles on exhibition ground lighting and electric towers. Such articles as these bring out strikingly the fact that exposition electrical work is an art by itself, but we doubt if all the conditions had been publicly discussed before, or at least by an expert and in this suggestive manner. It will be noted that Mr. Stieringer appears, from the evidence in his own articles, to have been studying these special subjects continuously for over 15 years. In this country no one else has a like experience, and probably no one in Europe has enjoyed equal opportunities. His brilliant success, culminating for the present in the Pan-American, has been seen and admired of all men.

It is in the closing sentences of the article that Mr. Stieringer reveals most as to the conditions that exposition experts, such as he, must always be studying. There seems to us no gainsaying his contention that the original exposition idea of public instruction is largely outworn and is overshadowed by the sensational or the amusement feature. It is increasingly difficult to show any really new thing at an exhibition, and in this respect, Professor Sever, superintendent of electrical exhibits, had a much more onerous task before

him at Buffalo than that encountered by either Mr. Stieringer, as consulting electrical engineer, or his accomplished associate at the construction end, Mr. Henry Rustin. As for electrics, it is true there is the Nernst lamp and the Edison storage battery; but the former was seen at Paris last year, and the latter was shown in this city early in the summer and elaborately described; so that neither is in any true sense a novelty. The same criticism would apply all through the Pan-American. It is not putting the case too strongly to say that any modern department store, like Siegel-Cooper's, or Stern's, is a Pan-American in itself; in fact, we believe that the new Macy's will have more floor show space than can be measured at Buffalo; while the goods represent all that is latest and best in a wonderfully wide range of human necessity and comfort.

Hence Mr. Stieringer's claim that the exhibition of the future must for its own sake continue to develop unduly its spectacular and amusement features, to succeed, appears well founded. It might be added that the later shows become more and more a night festival, in sharp contradistinction to the earlier ones, which closed at night; and it is here that electricity has its chance. As an agency, electricity is so protean and flexible, there is hardly any limit to what can be done with it, and we may boldly count on electrical novelties at future exhibitions surpassing anything now on record. Indeed, it is safe to predict that Mr. Stieringer and the St. Louis authorities have already forecast electrical spectacles of an unheard-of order of brilliancy and novelty. At the same time, they will never be able to efface from the memory the beauty and majesty of the spectacle presented by the Pan-American illuminated by energy from Niagara and seen in all its marvelous glory against the darkness of the night.

Discharge from High-Tension Transmission Lines.

This subject formed an interesting topic for discussion at the recent Buffalo convention of the A. I. E. E., and several matters of practical importance were reviewed. The discharges which may take place at the receiving end of a long aerial transmission line are various, and may be variously produced. Their common feature is an undue rise of pressure at the end of the line. The simplest of these is the disturbance of free oscillation in the transmission circuit, capable of being produced by a sudden change of any kind, such as a change of load, or a change of generator speed. All such departures from the steady condition of transmission necessarily give rise to temporary surgings that may have sufficient magnitude to produce a discharge from the line. Then there is the effect of high-frequency harmonic components in the generator e. m. f., which may develop a steady resonant rise of potential at the distant end of the line. Then there is the charging of the line-wires by electricity carried past them in moving air. The air is electrically charged or ionized, and a wind-movement of this air past the wires has the effect of handing over to the wires a portion of the charge. This is more frequently a cause of disturbance when a portion of the transmission line runs over a mountain range, since the difference of level between different parts of the line is usually accompanied by a difference in the potential of the air enveloping the wires.

Finally, there are disturbances due to lightning. The lesser of these are purely inductive disturbances. The greater are occasioned by the lightning flash passing directly over the wire or some portion thereof. The most serious and troublesome disturbances are those occasioned by lightning. In the Eastern States such disturbances are nearly all confined to the summer months; but in some localities they occur perennially. One preventive that has long been in use is a galvanized iron wire supported from the tops of the poles and grounded at frequent intervals. This wire, which is frequently barbed, not only offers special inducements to the selective passage of a direct lightning discharge, but it also affords a screening and sheltering influence against inductive disturbances to the working wires below it. To troubles which come from overhead, the overhead ground-wire gives relief. It affords, when barbed, a partial protection against charges by wind movement of electrified air. The only disturbances from which it grants no relief are those of resonance or surgings, developed from within the circuit. The galvanized iron wire also acts in some instances as a guard wire against wires falling from above. Its disadvantage is its extra cost, its liability to come into accidental contact with a working wire, and inconvenience in being handled or erected when barbed.

The International Engineering Congress.

An International Engineering Congress has recently been held in Glasgow, Scotland, under the auspices of the Glasgow International Exhibition. One of the features of interest visited is a 27-hp "Newcomen" engine, stated to have been steadily operated at Rutherglen Colliery since 1809. Its boiler pressure is 3 lbs. per square inch, above that of the atmosphere, and the mean effective pressure 7.35 lbs. per square inch. Such an engine is a curiosity in these days of high and increasing boiler pressures. It is said that no part of this engine has been renewed, with the exception of one or two accidentally broken spur-wheels. The consumption of coal per ihp-hour is not stated, but for a small engine at the mouth of a colliery pit there is probably "coal to burn." There ought not to be any great danger from explosion at a boiler pressure of 3 lbs. per square inch. It is described as being operated by hand. A man admits steam into the vertical cylinder below the piston by turning a handle, and then cutting off the steam, admits water to condense the steam, the atmospheric pressure forcing the piston down. This, if primitive, is at least simple. The engine, still in service, hoisting coal to the surface, is said to be the oldest engine at work in Scotland, and the only "atmospheric" engine in use in Gerat Britain. This engine's active career down to the present time is another evidence of our British cousins' aversion to the scrapheap.

Burning by Becquerel Rays.

It has been recently announced in the *Comptes Rendus* that the invisible rays emitted by radium have an active effect upon the human skin. It is well known that X-rays, if sufficiently intense and in sufficiently long duration of action, exercise a destructive action upon the skin, which peels off and leaves an open sore that is slow to heal. Recently Walkoff and Giesel observed a similar action exerted by radium. Mr. H. Becquerel now describes the effects noted by him on his own person. He carried a few decigrammes of radiferous radium-chloride, inside a small sealed tube, in his waistcoat pocket for a total length of time amounting to about six hours. In ten days a red mark, corresponding in position to the location of the tube, developed on his skin. It was followed by peeling and suppuration, and the sore did not heal for a month. This will add one more to the cheerful list of possible skin diseases that civilization enables us to classify, develop and diagnose. In addition to the ordinary sun-burning which is prevalent in the northern hemisphere about this time of year, and is sought by giddy girls or callow boys, we have arc-light burns, X-ray burns and Becquerel-ray burns. It seems likely that the action in each of these cases is similar, but a careful comparative investigation into the differences of action would probably be both useful and interesting. While the sun burns at a distance of ninety-odd millions of miles, the arc light and Crookes tube act at a few centimeters, and radium at a few millimeters.

HIGH-TENSION SWITCHING.

The question of switches for high-tension circuits has been an ever present one for the past five years. As voltages have been steadily increased from five to fifteen, twenty, thirty and forty thousand volts, high-tension switches have hardly been developed rapidly enough to keep up with the voltages in use. Up to 12,000 volts the ordinary oil switch is now in daily use giving satisfactory results, and its perfection for higher voltages is promised. Indeed, from the experiments described in the Institute convention paper by E. W. Rice, Jr., which paper appeared in our last issue, there is every hope that an oil switch will soon be commercially available for circuits of 40,000 volts. In the majority of transmission plants using voltages from 20,000 to 40,000, it is hard to find an engineer who is satisfied with the present high-tension switching facilities in his plant. The last convention of the Pacific Coast Electric Transmission Association devoted a large portion of its time to a discussion of high-voltage switching. When a body of such veteran high-voltage men as those on the Pacific Coast discuss the subject at great length, it shows the importance of a solution to the problem with which they have been confronted. The paper by Mr. Rice just spoken of describes some experiments on opening high-voltage circuits in open free air, which make it seem not strange that present open-air switches are somewhat uncertain in operation. When a 40,000-volt circuit can produce a 30-ft. arc upon the breaking of a short circuit, there is reason for wondering why some of the present devices work as well as they do. The reason for such long arcs upon the breaking of high-voltage short circuits is fully taken up in Mr. Steinmetz's Institute convention paper, which we published in abstract and commented upon recently. Both theory and practice show that the surgings which take place upon the opening of short circuits on high voltage lines may give rise to a voltage much above the normal operating voltage.

The consensus of opinion among those who have to deal with high-tension lines is something like the answer to the conundrum, "Where would you rather have a boil?" Answer, "On the other fellow." The best way to do high-voltage switching is to do it on the low-voltage side of the transformers, and as little of that as possible. The great bulk of the switching under load on a high-voltage plant can be done exactly as well and even better on the low-voltage sides of the transformers. Indeed, in case of short circuits it is in some plants customary to go even further back when it is necessary to kill the line, and open the field circuits of the generators. An analysis of all the conditions under which it is necessary to open transmission circuits shows that the number of times that it is absolutely essential to open such circuits under load is very small. For example, the most common switching operation is that of cutting out a bank of transformers. This can be done on the low-tension side first, leaving only the exciting current of the transformers to be broken on the high-tension side. Some even advocate leaving the transformers in rather than open the high-tension side under no load. In case of a prolonged short-circuit on the high-tension line, it is again not only possible but best to open the low-tension circuits first. There is really only one case which arises where an interruption to the service would be prevented by the opening of high-tension switches, and where the same end could not be accomplished by opening low-tension switches. This is where a transformer is burning out and it is desired to cut it out without interrupting the service. Here it is necessary to open the high-voltage circuit under a very heavy current, and it is for such rare emergencies that high-tension switches are most needed. The almost incredibly long arcs which are drawn out by a long air-brake switch, as previously mentioned, make its performance a matter of considerable uncertainty under the various conditions that occur in practice, and it is seldom that enough room is allowed for this. The simplest device yet proposed is the horn switch used at Los Angeles and in Continental Europe, in which the arc is drawn between two horns, travels up in an ever-increasing length, and is finally broken by being drawn out by the air currents. Unfortunately the use of this simple device is not sufficiently widespread so that the results it gives under all conditions are known, and it is a question how far it can be depended on.

POLYPHASE RAILWAY MOTORS.

The papers of Messrs. Berg and Armstrong at the Buffalo meeting of the A. I. E. E. with the ensuing discussion, formed a well directed and concerted attack on schism and heresy in electric traction. We are disposed to take a conservative position in such matters, fully realizing that the art of electric traction has suffered in the past through the frequent changes in apparatus. But we are hardly prepared to hold that polyphase motors are altogether good and desirable for ordinary purposes, and entirely worthless and reprehensible for traction. We run mentally back over a decade or so and recall the whole-souled unanimity with which the direct-current contingent, armed with unassailable data and panoplied in commercial cock-sureness, fell upon and smote the venturesome wight who whispered "drehstrom." They showed that he was intrinsically anathema, and insinuated that drehstrom implied cerebral wheels. It is a long reach from those days to the Buffalo convention, and the world has moved meanwhile. Now, the polyphase motor seems so glorious a vision that to learn its fatal weakness for electric traction almost gives a cold shiver. It makes us think of the scorn and contumely that ten years ago greeted the impudent proposal to use a series-parallel connection on electric cars. It was proved beyond controversion to be an impractical scheme conjured up by some of those theoretical fellows who thought they could work laboratory appliances off on practical engineers who alone understood commercial conditions.

With all levity aside, we do not think that there have yet been made, in this country at least, attempts at fitting induction motors for traction service of a sufficiently persistent and serious character to justify the abandonment of further efforts, or the prediction of definite limits to their usefulness. Messrs. Berg and Armstrong showed very clearly and fully that in some of the common cases of heavy electric traction, induction motors with the means for speed regulation just now available, were at a very serious disadvantage. So far, so good; but we do not think the conclusion justified that even very modest improvements might not swing the balance the other way. Rheostatic control is unmistakably inefficient when it has to be used to the extent assumed by Mr. Berg; and the concatenated control, adding as it does the reactances in two motors, is notoriously bad in the matter of power factor. But if Mr. John Smith, of Nova Zembla, had basic patents on the series-parallel control fully sustained against all comers in the Circuit Court of Appeals, we would be willing to wager a neat sum that Mr. Berg and his talented colleagues could, and would, devise a practical and efficient scheme for using induction motors within 90 days after the date of Mr. Smith's permanent injunction against them. We should much dislike to see the present economical and well standardized apparatus for electric traction disorganized by the introduction of half-baked experimental apparatus of half-a-dozen degrees of impracticability, but we have learned to go slow in predicating finality of any current electrical apparatus. The time will come when for some well defined purpose it will prove advisable to use induction motors for traction; and when the problem is attacked with a direct necessity spurring American engineers to action, we are not inclined to predict their failure. Until the whole matter is submitted to the touchstone of persistent experiment, we cannot be sure whether the subject of dispute is gold or dross. The facts brought out at the Buffalo meeting apply to conditions as they are here and now, not elsewhere or to-morrow.

The Attempted Assassination of President McKinley.

Late on Friday afternoon, Sept. 6, the country was thrown into a state of consternation and indignation by the news that while holding a public reception in the Music Hall at the Pan-American Exposition, President McKinley had been twice shot with a revolver by an anarchist. As soon as possible, the president was removed from the Exposition hospital to the residence of Mr. Milburn, where he had been staying with Mrs. McKinley, and the wires of the Western Union, Postal Telegraph and Bell Telephone Companies, with police and messenger alarm systems were immediately run to the Milburn property and a force of operators was installed. An enormous amount of private and press matter was immediately thrown on the telegraph wires, and the telephone long-distance service into Buffalo was also soon overloaded. The news was quickly known around the world, and cable messages have kept the submarine cable companies also very busy ever since.

On Saturday the physicians decided that Mr. McKinley's room ought to be kept cooler, and Mr. Charles R. Huntley, general manager of the Buffalo General Electric Company, took the matter in hand personally and spent the morning running the necessary wires, putting in fan motor equipment for the comfort of both Mr. and Mrs. McKinley, the latter being also, as is well known, in a most critical condition of health. Such work was never done with greater celerity.

At the same time, Mr. Cortelyou, private secretary to the President, telephoned over the long-distance wires to Mr. Edison at Orange for the best Röntgen ray outfit he could send, in order to help the doctors in finding and removing the second bullet, still in the President's stomach. Mr. W. E. Gilmore, general manager of the Edison shops, complied promptly with the unexpected requisition, and dispatched the outfit the same night, so that it reached Buffalo on Sunday morning and was at once installed ready for use. Dr. Knoll, of New York, and Messrs. Luhr and Dollie, from the Edison laboratory, went with it. At this writing the time of its use is not settled.

It is interesting to electrical people to know that in his address at the Pan-American, delivered just before the attempt at assassination, Mr. McKinley dwelt on the remarkable achievements of telegraphy, and insisted that one of the things that this country must do soon was to lay a Pacific cable. On Friday, just prior to the foul deed, he made a trip to Niagara Falls, and in company with Secretary W. B. Rankine, of the Niagara Power Company, spent some time inspecting the great power plant, with which he expressed himself delighted. On his return from this trip he went to the Music Hall at the Pan-American.

It will be remembered that when President Garfield was shot the "induction balance" was suggested and used with the object of locating the bullet. Although Mr. McKinley is a man of very sturdy build and solid frame, it is believed by experts that a successful location of the stray bullet can easily be made. It would seem that the bullet has probably lodged in the muscles of the back, where the rays can readily detect its exact location. Fortunately, up to this time of writing (Tuesday), there are no symptoms of blood poisoning or peritonitis to complicate matters.

Electrical Engineers of the Day—XI

GANO S. DUNN.

Gano Sillick Dunn, though not yet thirty-one years of age, has been connected with the electrical profession for more than 15 years. Like so many other prominent electrical engineers of to-day, he began his active career as a telegraph operator, having been compelled, owing to financial reverses in his family, to abandon preparation for Yale and begin to earn his living before he was fifteen years of age. For six years he was employed as an operator by the Western Union Telegraph Company, filling afternoon and night positions, and during the whole of this period he was attending college, supporting himself and helping support his family out of his earnings.

He graduated in 1889 from the New York City College, standing close to the head of his class, in spite of the fact that his long hours of work outside of the college made it almost impossible for him to find proper time for study. In 1891 he graduated from the newly established post-graduate Electrical Course of Columbia University, receiving the first degree in electrical engineering ever given by that University. In 1897 he received the degree of Master of Science from the New York City College. Immediately upon his graduation, Mr. Dunn was given temporary employment by the Crocker-Wheeler Electric Company to do some special experimental work. His ability, however, was so quickly evident that he was retained in the employ of the company, and has been with them ever since, most of the time as chief engineer.

It is but seldom that one who is peculiarly successful in executive and commercial lines, is at the same time possessed of ability to design apparatus when that designing means the most exhaustive study of abstract theoretical considerations. For many years Mr. Dunn has been the responsible and active designer of the Crocker-Wheeler machinery, and so thorough has been the preliminary study of the electrical and mechanical design that changes after the drawings are made are almost unknown, except when after a period of several years the general advance of the art and change of conditions may call for the development of a new line of machine. Space conception, æsthetic feeling for harmony of outline, the tendency to adhere to lines of simplicity and strength—in short, the ideal qualifications of the mechanical designer—are, as a rule, not found associated in a mind that can readily comprehend the intricacies of wave forms, and the highly complex reactions associated therewith; but Mr. Dunn has shown remarkable strength in both lines.

Perhaps the most striking thing about Mr. Dunn's career is the confidence which he inspires in those with whom he has business or

social relations. No greater evidence of genuine ability could be presented than the way in which he has stepped promptly into the front rank, and been given important executive responsibility in every organization with which he has been connected. He was made a director of the Crocker-Wheeler Company at twenty-five, several years later a member of the executive committee, and is now acting vice-president. He became vice-president of the New York Electrical Society at twenty-five, and its president at tweny-seven, and after serving as manager was elected vice-president of the American Institute of Electrical Engineers at twenty-eight.

Under Mr. Dunn's administration as president of the New York Electrical Society the membership was greatly increased, its finances improved and new life put into the organization, the high standing of which at the present day is, to a large degree, the result of his efforts. Mr. Dunn has been too hard a worker from early boyhood to find much time for writing, but the few articles which he has published have taken high rank and are considered authoritative by those best informed on the subjects on which he has written. One of his lectures delivered in 1896 on dynamo and motor design was referred to editorially in one of the prominent electrical papers as the "clearest exposition of the subject in hand that has ever been given in the language." This lecture was printed and several thousands of copies were sold. Mr. Dunn has also delivered lectures before the Franklin Institute and various engineering societies.

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A Brief History of Luminous Fountain Development.

By Luther Stieringer, A. I. E. E.

THE origin of the illuminated fountain is veiled in obscurity. Admitting this fact at the start, it is evident then that any paper or survey designed to be an historical record can be such only so far as our light or knowledge penetrates. We may, however, concede that the principle was without doubt crudely applied long before the Christian era. The sources of light were, in all probability, originally fagots, candles, or oil, supplemented possibly by reflectors. Later on gas and the calcium light were used, and color was added to further embellish the display made and create the effect sought for.

We know, however, that the principle governing the luminous fountain was first stated by Professor Colladon, in a communication to the French Academy of Arts and Sciences in 1842. M. de Bovet also mentions having seen a small luminous fountain in 1879 or 1880 at Ouro Preto, the capital of one of the provinces of Brazil. This fountain was exhibited at the City Theater by a traveling showman. It embraced a reservoir placed on the roof of the building, a few tin pipes and a Drummond light.

It was Sir Francis Bolton, of England, who first employed electricity in the luminous fountain, the year being 1884. The perfected result of his labors was exhibited at the Healtheries Exposition. This fountain (Fig. 1) was installed in the center of a lake at the Exposition grounds, London. It consisted of a hollow mound of timber, in which the piping and the necessary apparatus for operating the light and color, as well as the water effects, were concealed. The level of the water in the basin was maintained within the fountain chamber, and as the deck or roof was less than 6 ft. from the bottom of the basin level, there was not enough head room to allow of the construction of platforms or raised flooring, and so the operators were forced to wear high rubber boots. In the roof of the chamber there were glass-enclosed light shafts, each having various forms of water jets issuing from their surfaces. The color effect was secured by the use of sliding frames of colored glass, to the number desired, interposed between the light and the streams of water. There was one set to each lamp and light shaft, and 30 ampere hand-feed lamps were used. Fresnel lenses of the light-house order were employed to parallel the rays. The water supply

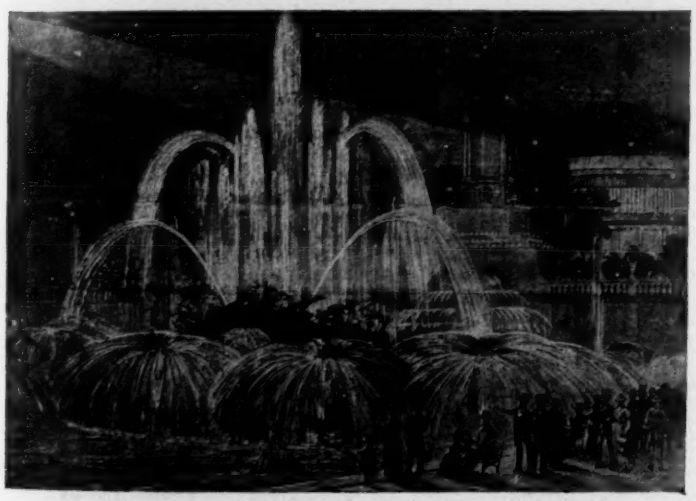


FIG. 1.—FOUNTAIN, HEALTH EXPOSITION, LONDON.

was regulated and manipulated by quick-acting valves. When in operation, signals were transmitted from an observation tower to the attendants in the operating chamber of the fountain, who had charge of the light, water and color effects. This fountain was the first spectacular fountain strictly operated as such, by being continuously in play, and never exceeding 15 minutes' display at any given performance, this being the limit of the effective changes possible with the number of combinations afforded in the design. It may be remarked that this fountain in its construction was a combination of the geyser and figure types.

Inspired by the success of this fountain, Mr. Erastus Wiman arranged with Sir Francis Bolton to design an electric fountain for the St. George's Amusement Company, of Staten Island, N. Y. The fountain so erected was installed and publicly operated in 1885, and it bears the distinction of having been the first luminous fountain seen in the United States. (For particulars, see *Electrical World*, Nov. 8, 1885). The original design of this fountain showed a square masonry basin holding water to a depth of 4 ft. (Fig. 2). In this basin there were arranged 16 light shafts, while in the chamber beneath the color screens and other necessary apparatus were installed. Fresnel lenses similar to those in the London fountain men-

FIG. 2.—ST. GEORGE, STATEN ISLAND, FOUNTAIN.

tioned were designed to be used. Mr. Wiman became quite interested in fountain work, and bought a patent from Sir Francis Bolton of a floating fountain capable of being sent to different harbors, or to river towns, there to be displayed as an attraction. However, no fountain embodying the ideas of the patent has ever been built.

In 1884 the Franklin Institute installed an electric fountain in their exposition building. Owing to the large amount of illumination in the building, it proved a failure. (See *Electrical World*, Sept. 13, 1884.)

Acting under the advice of the writer, retained as consulting engineer, the Staten Island fountain basin was reduced in height to admit of a better view. The wheatsheaf water effect was also introduced, this marking the first instance in which it was employed. The majority of the other streams of the fountain were horizontal, and were directed to the center of the basin. There was delay in securing the Fresnel lenses, which, together with their great cost, led the writer to recommend the use of the ordinary locomotive headlight, or parabola reflector. The recommendation was adopted, and the preliminary trial proved very satisfactory. This method of reflection has since been employed in all fountain work, the only exceptions being where intense beams of light are required externally, and at the Paris Exposition of 1889, where some plain mirrors were used. The final report, however, admitted that these mirrors were inferior to the parabola.

After 1886 the Staten Island fountain was put out of commission, and was finally sold to Mr. Yerkes, of Chicago, and by him erected in 1892 in Lincoln Park, of that city, it having been presented to Chicago as a permanent attraction. The site selected for this fountain is on rising ground, the surroundings enabling a dark environment during its operation. This fountain has been in operation every season since 1892. The water pressure is only 40 lbs., and the lamps are comparatively small, 30 amperes. Even with these drawbacks its location secures other advantages. (Fig. 3.) The design in rectangular form within a circular basin does not harmonize as well as in the square basin setting of the original design at Staten Island.

The electrically luminous fountain at the Paris Exposition in 1889 was the largest and most elaborate ever constructed up to that date, and was a decided feature of the Exposition. It consisted of two parts, one of French the other of English design, and embraced plans similar to those embodied in the fountains previously shown at Manchester, Glasgow and other places. This Paris fountain was without doubt one of the main features and attractions of the Exposition. It was of the combination order, consisting of an em-

blematical section and a geyser fountain built and operated by the English firm of Galloway. Some of the streams in the French section of the fountain are worthy of note because they were arranged to descend from orifices intensely illuminated, producing an effect of solid, luminous liquid streams. Their height, however, was restricted to a 7-ft. fall. This is an effect that has not since been repeated. The Staten Island fountain transferred to Lincoln Park, and there installed in 1892, was the immediate successor of the Paris fountain of 1889 (Fig. 4). (For particulars see *Electrical World*, June 26, 1886.)

With the conception and creation of the World's Columbian Exposition, of Chicago, there came a natural desire to excel not only the Paris Exposition fountain display, but everything of the kind

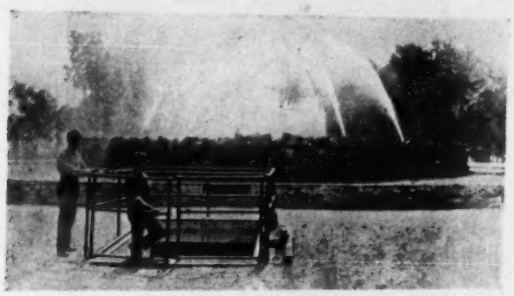


FIG. 3.—LINCOLN PARK, CHICAGO.

ever attempted. It was recognized that the spectacular effects of the beautiful luminous fountains delighted people, and so an early consideration of the subject was enforced. Owing to the difficulty in securing tenders for complete installations for two electrically luminous fountains, little progress was made. Strange to say, the only tender offered was from abroad, and exceeded by 50 per cent the contract price finally agreed upon. This tender included only the necessary apparatus for the operation of the fountains independent of such construction as was contemplated by the Exposition management. The difficulty of securing a suitable and at the same time practical site for the fountains and the consequent delay in maturing any specific plans, deferred the initial construction until a very late date. Finally, it was decided, as a matter of necessity, to place the fountains in the Grand Basin, on either side of the McMonnies Columbian fountain. Thus they had the Administration Building as a background, and were flanked by the Electricity, Machinery and Liberal Arts buildings. The great size of these edifices, whose cornice lines were from 60 to 70 ft. above the fountain terraces, and the proximity of the immense structural McMonnies fountain, made it imperative that the electric fountain should be of such proportions as not to be dwarfed by the magnitude of

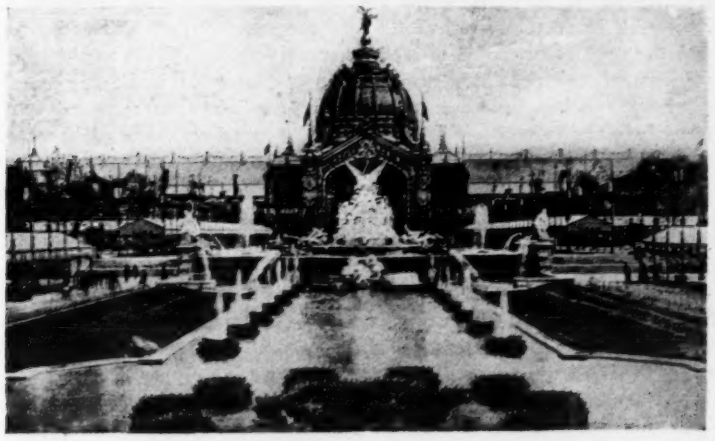


FIG. 4.—PARIS EXPOSITION, 1889.

the setting which formed one of the principal conditions under which they must operate. The whiteness of the buildings, together with their strong interior illumination, made necessary the employment of very powerful lamps in the fountains in order that their spectacular effect should not be impaired. Due recognition was given all these difficulties by the writer, as consulting electrical engineer of the Exposition, to whom the task of preparing the plans that were finally adopted fell. These plans developed many new features (Fig. 5), the entire installation being on a larger and more comprehensive scale, in every respect, than ever before or since attempted, with the additional feature of a marked economy in construction and operation over all previous fountains of similar character. (For particulars, see the *Electrical Engineer*, May 3, 1893.)

In the construction many natural obstacles were encountered. Excavations had to be made in sandy ground and a water-tight chamber built 8 or 9 ft. below the lake water level. The projected use of an iron caisson was abandoned in the face of many difficulties which presented themselves, and a special construction was adopted. Piles were sunk into the ground, and upon the shorter ones a floor of interlacing beams was laid, upon which concrete was run to form the floor proper of the chamber. Longer piles served as columns for the support of the wooden water deck, and also for the framing against which the Wakefield sheet piling, in three layers, three inches thick, 12 in width and 20 ft. long, lap-jointed, was allowed to rest, the same being sand-jetted in, thereby securing a water-tight chamber, entrance to which was gained through a water-tight passage. Within each of these subaqueous chambers the projector lamps, the color screens, the switchboards, the signal indicators and ventilating apparatus were located. In each chamber there were 19 special, 90 ampere arc lamps, estimated to give a beam of light of 250,000 candlepower each.

In prior fountains, color screens were laboriously slid in and out like lantern slides. In this instance the umbrella screens were so geared together that they could all be revolved together easily by a single attendant and at a higher rate of speed. The signaling apparatus was both efficient and complete, and embraced the color, valve and other signals in each fountain. When operated to full capacity, each fountain required 22,000 gallons of water per minute. There were 19 composite groups of jets in each fountain with a total of 1710 jets. Each of these fountains had a greater number of water orifices, electric lights and water supply than had been before or has been since installed, of similar type. The Paris fountain had only 17 light shafts, while the Chicago fountains each had 19, or a total of 38. When the lights on the Exposition grounds and the exterior of the adjacent buildings were extinguished, and when high winds, which served to disturb the sprays, were not prevalent, the results were highly satisfactory. The *Chicago Herald* of June 16, 1893, had this to say of this fountain construction:

"Suddenly the lights vanished. In their places rose, though not to a great height, two streams of water, sparkling as in the brightest sunlight. When those two artificial geysers spouted high up above the domes of surrounding buildings, a mighty and involuntary exclamation of gladdened surprise rose from the multitude that saw them. The spouting columns danced and sparkled above the great parabolic reflectors, whose surfaces concentrated upon them the light

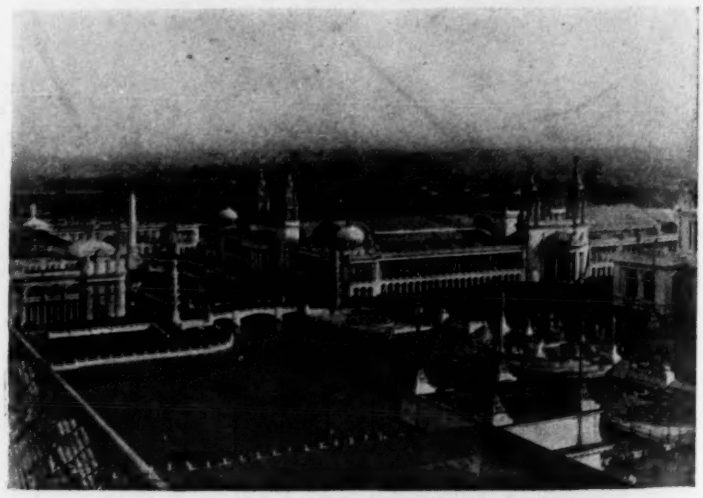


FIG. 5.—CHICAGO, 1893.

of many thousand candles. From pure white they were changed with the rapidity of kaleidoscopic transformations into all the colors of the prism. They were shaded one into another, bringing delight with every change, little ones about it fairly bubbled over the surface of its apparent source. Then more power was turned on, and every little jet rose until it reached the height of the central one, and all fell in one dense mass in spray. The people cheered the changes. They clapped their hands and shouted until palms ached and voices grew hoarse. With the successful operation of the foun-

FIG. 6.—SAN FRANCISCO.

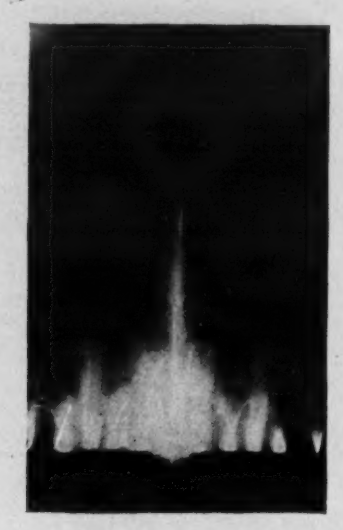


FIG. 9.—TWIN LUMINOUS FOUNTAINS, ATLANTA.

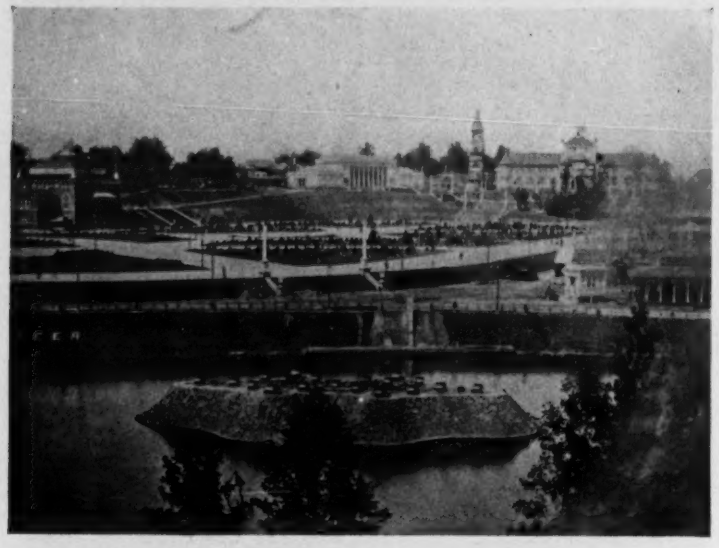


FIG. 8.—ATLANTA, WITH UNFINISHED TOP, SHOWING LIGHT SHAFT AND PIPE.

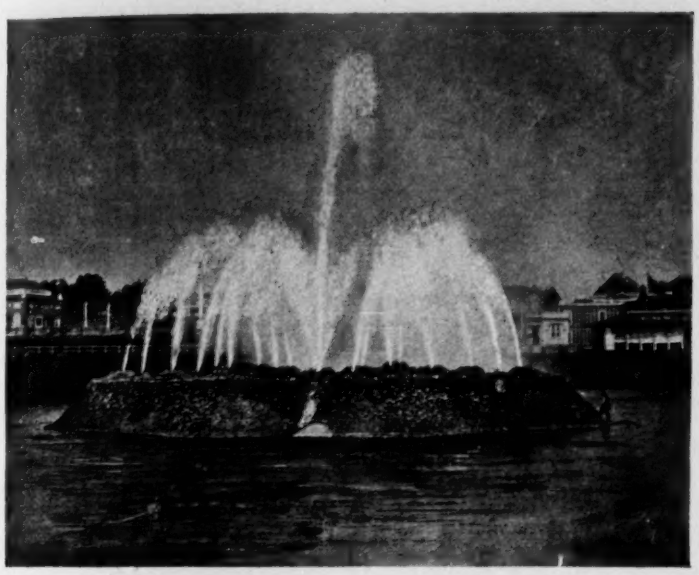
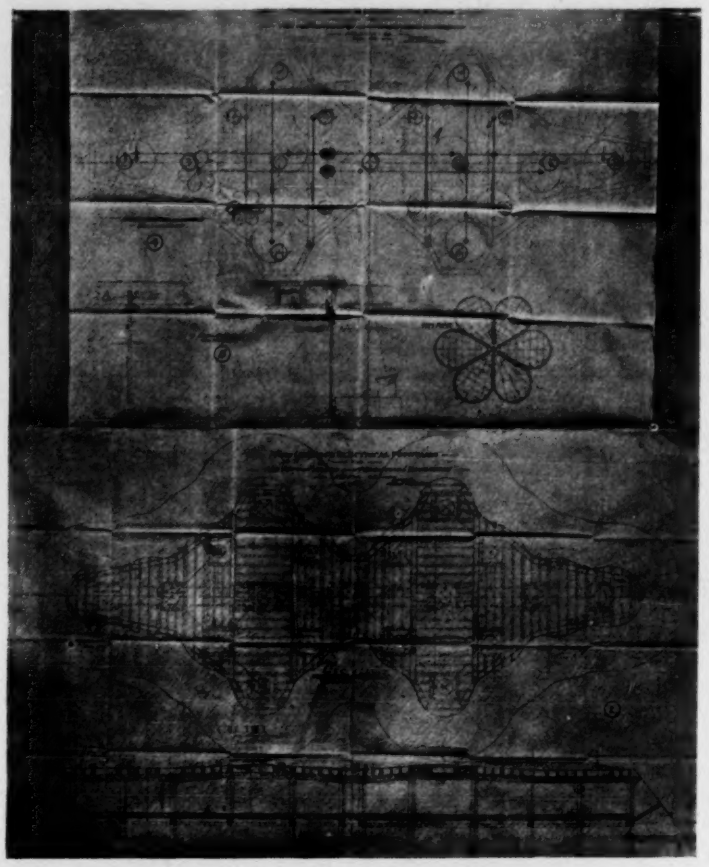


FIG. 8A.—ATLANTA FOUNTAIN.



FIGS. 10 AND 11.—COLOR SCREEN PLAN AND TIMBER PLAN, ATLANTA.

FIG. 7.—ATLANTA FOUNTAIN IN COURSE OF CONSTRUCTION.

THE DEVELOPMENT OF ELECTRIC FOUNTAINS.

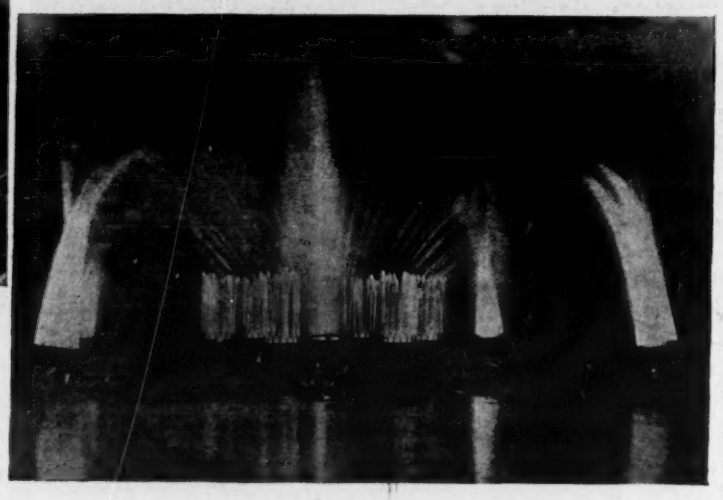


FIG. 12.—SCHENLY PARK, PITTSBURG.

tains their cup of happiness was full, but ere their surprised senses had taken in the first effects of the beauties unfolded to their view by combinations of light and water another display was before them."

One of the Columbian World's Fair fountains was removed to the Midwinter Fair in San Francisco, and operated during 1894. (See *Electrical Engineer,* May 9, 1894.) The only change made was in the fountain basin, as shown in the illustration. (Fig. 6.) At the Atlanta Exposition of 1895 a new departure in electric fountain work was demanded. The writer, as consulting engineer of the Exposition, reported on all plans submitted. The objection to the cost of previous forms necessitated a special design involving simplicity and economy. To meet these conditions the consulting engineer was authorized himself to prepare plans, which were finally accepted, and a fountain was installed under his supervision. This fountain consisted of a rocky mound constructed of timber covered with rockwork, as shown in the illustration (Fig. 8). This formed a hollow chamber and was built on a framework in the center of an artificial lake. All supporting timber of the structure was concealed when the lake was filled to the proper level (Figs. 7, 8, 8*a* and 9). Within the fountain chamber sufficient room was provided to place and operate all the electrical, water and color screens and apparatus. In this fountain, special 60-ampere lamps were used, also four searchlights placed on Machinery Hall, about 400 ft. distant from the fountain. These served to illumine the high streams. A 24-inch water main attached to powerful exhibit pumps, located in Machinery Hall, furnished 16,000 gallons of water per minute at a pressure of 110 lbs. Some of the plans of the fountains as installed are shown in Figs. 10 and 11. This fountain was known as the "Twin Luminous Fountain Atlantis," and proved very successful. So impressive was it that music was written for it, while the newspaper articles were very elaborate.

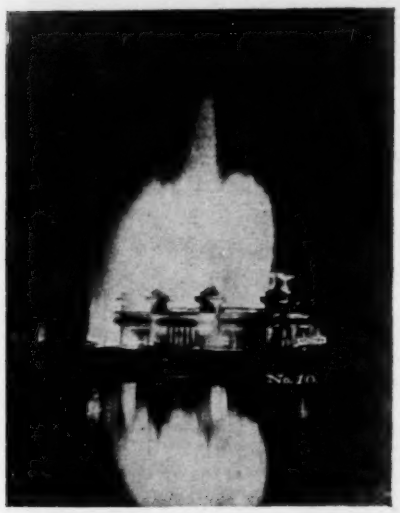


FIG. 13.—WILLOW GROVE FOUNTAIN, PHILADELPHIA.

One of the Atlanta papers had this to say: "The electric fountain is another triumph of the Exposition. Here again a new fairyland is opened. The wheat sheaves might be the ones that Joseph dreamed of, for somehow they have got mixed with the coat of many colors. First, there is the golden grain, tall and waving, and bending under its bearded load as at harvest, then the field is turned to green as if Joseph's bad brothers had taken part in the dream, then comes a dull red as of bloody thoughts, and then a violet is succeeded by another of pearl, as if dreams were fading into morning. Water is a wizard in making colors, and when the fire artist adds this element to his palette he makes pictures which surpass description. They give the observer a kind of intellectual feast which may be enjoyed and remembered, but may never be hung in cold type." This popular eulogy was supplemented, it may perhaps be fitting to note, by a medal of St. Gaudens' design.

At Schenly Park, Pittsburg, Pa., in 1894, a fountain of the geyser type (Fig. 12) was installed under favorable conditions as to site, and has been operated every season since with successful results. At Willow Grove, a pleasure resort near Philadelphia, a structural fountain was installed in 1896. It has been operated right along. (For particulars, see *Electrical Engineer,* Oct. 31, 1896.) This fountain (Fig. 13) possesses the characteristics of the Atlanta fountain in not having a submerged chamber, the structure being of considerable height above the water basin, as portrayed in the accompanying illustration of it. The environment of this fountain has an excess of light, thus neutralizing the advantages of a dark setting, which would enhance the effect many fold.

In 1896 a fountain of the structural order and modified geyser type, electrically luminous, was erected in Budapest. A picture plan and daylight view are shown herewith in Figs. 14 and 15. (For particulars, see *Electrical Engineer,* Oct. 31, 1896.)

At Prospect Park, Brooklyn, in 1897, a fountain of the World's Fair type was installed (Fig. 16). It had 19 light shafts. The site selected was a poor one, an excess of extraneous light, disturbing

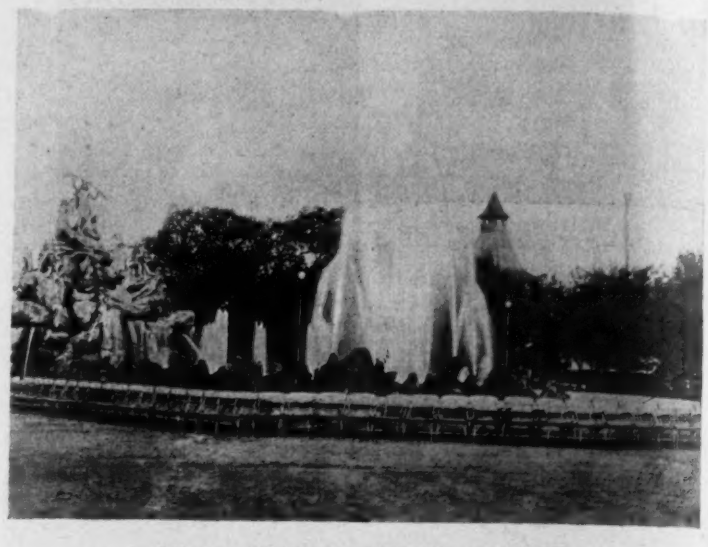


FIG. 14.—BUDAPEST FOUNTAIN, DAY VIEW.

street car traffic and other objectionable features neutralizing the best effects obtainable.

At Washington Park, a pleasure resort on the Delaware River a few miles below Philadelphia, a spectacular fountain has been in operation since 1898. This (Fig. 17) is the first outdoor fountain display of the stage order. It introduces living figures in prearranged poses, and while seemingly enveloped in jets of water, the figures are only veiled with water curtains of various designs. This fountain is the largest of this type and is badly located, being in the midst of too much light. Possessing novelty, however, it has proved satisfactory to the people visiting this resort. A number of fountains of this type, on a small scale, are now installed at different resorts in the United States.

In 1900 a fountain was erected in Crystal Palace, London. It was of the Chicago World's Fair type (Fig. 18), and has a beautiful setting, the surroundings enabling the best results to be obtained during its performance.

The Omaha fountain (Figs. 19 and 20) was named "Nautilus," and was the result of experiments made in one of the lakes at At-

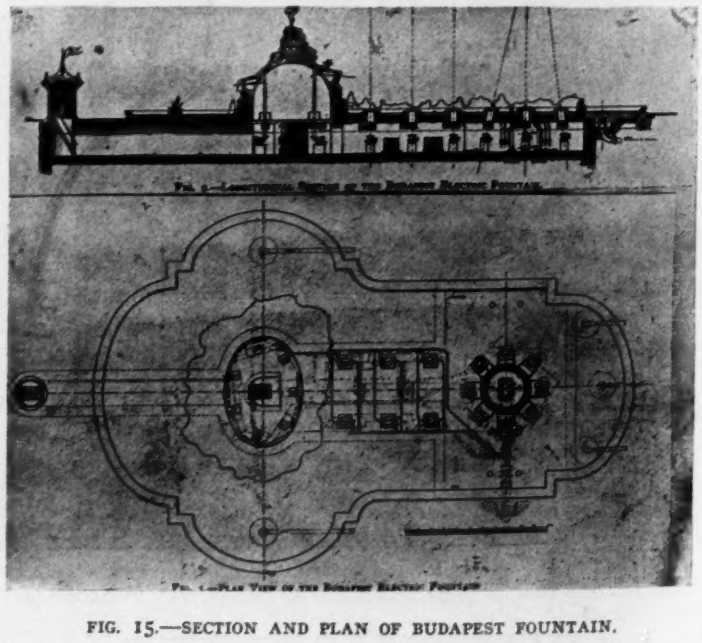


FIG. 15.—SECTION AND PLAN OF BUDAPEST FOUNTAIN.

lanta in 1895 by the writer. It was of the exteriorly illuminated type, a combination of incandescent embellishment and arc projectors. (See *Electrical Engineer* of May 19, 1898.) When the water was at fixed flow and designed to harmonize with the surroundings, pleasing effects were obtained at small cost. It may be remarked, how-

FIG. 16.—FOUNTAIN, PROSPECT PARK, BROOKLYN.

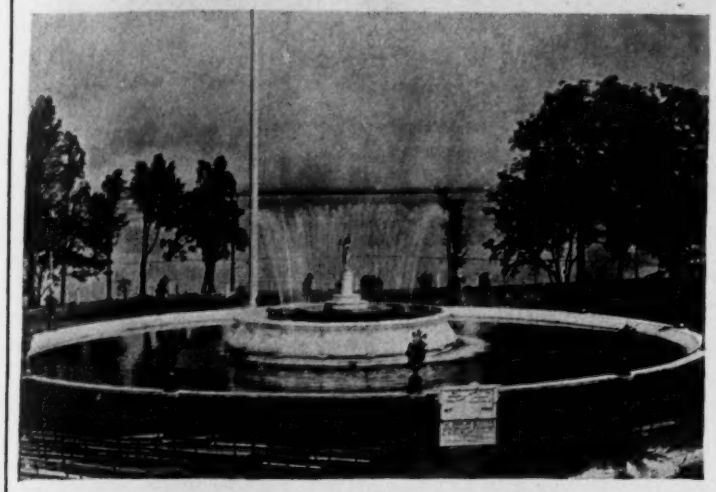


FIG. 17.—WASHINGTON PARK FOUNTAIN.

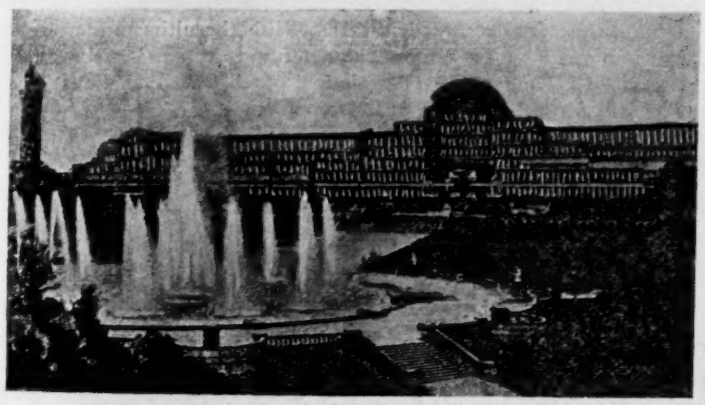


FIG. 18.—CRYSTAL PALACE, LONDON.

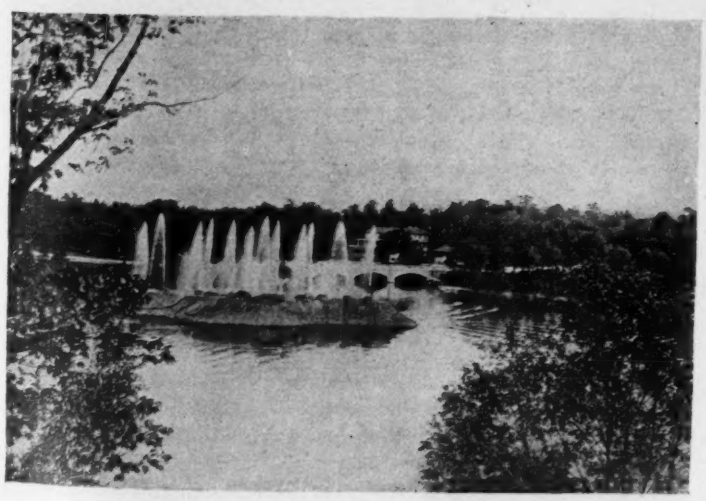


FIG. 19.—PAN-AMERICAN, LUMINOUS FOUNTAIN, OMAHA TYPE.

FIG. 20.—OMAHA EXPOSITION, NEPTUNE FOUNTAIN.

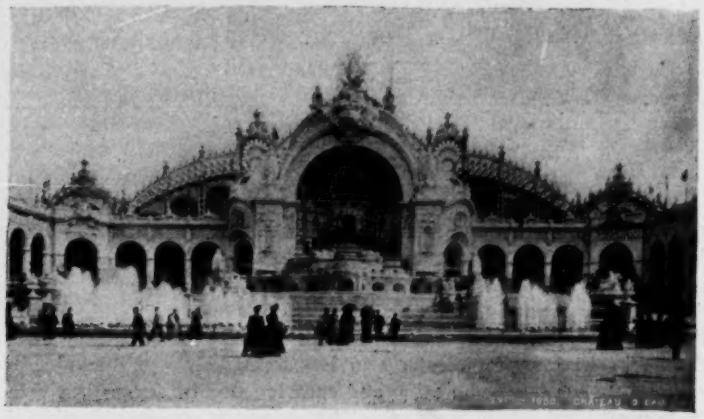


FIG. 21.—CHATEAU D'EAU, PARIS EXPOSITION, 1900.

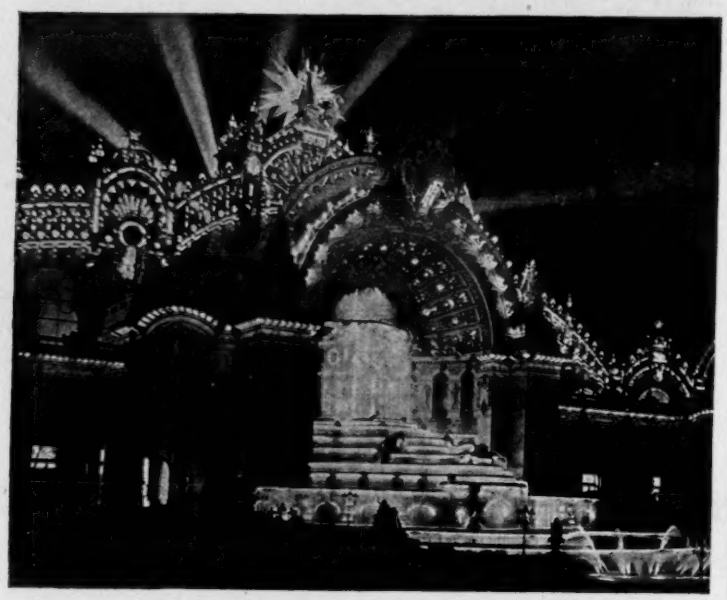


FIG. 22.—PARIS EXPOSITION, 1900.

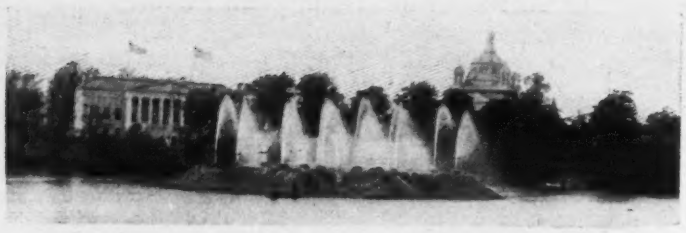


FIG. 26.—PAN-AMERICAN LUMINOUS FOUNTAIN BY DAYLIGHT.

ever, that exposition settings are generally on a large scale, and require the largest fountain creations. Many small fountains of a permanent character have been illumined by various methods of lighting. The floating lights were first introduced at Atlanta, later

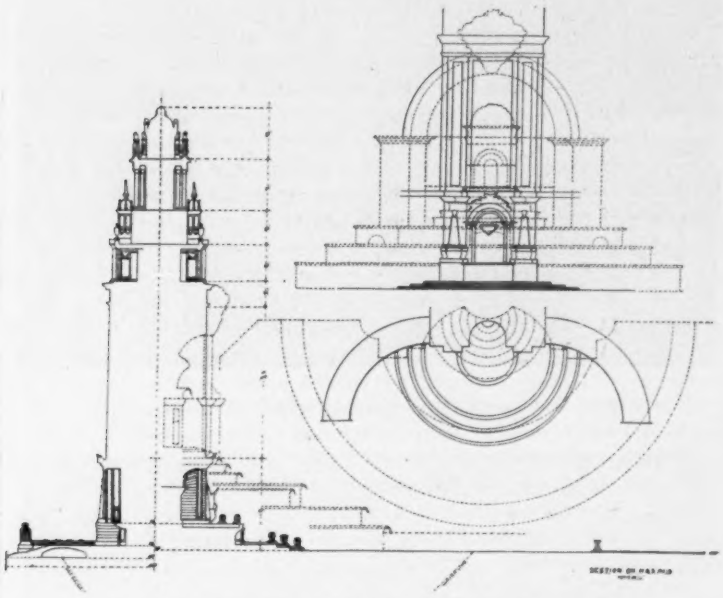


FIG. 23.—COMPARISON OF PARIS AND PAN-AMERICAN.

at Omaha, and still later at the Pan-American Exposition in Buffalo, in the Main Court Fountain basin.

The Paris Exposition management of 1900 early projected to make their electric fountain and cascades the main feature of the exposition. The Chateau de Eau is shown in Figs. 21 and 22. (See details in ELECTRICAL WORLD AND ENGINEER, Sept. 1, 1900.) For comprehensiveness, elaboration and completeness of design this conception excelled all prior efforts. The writer, as consulting engineer of the Pan-American Exposition, appreciating the magnitude of the Paris fountain and cascades, and realizing that the proposed Howard Tower fountain conception for Buffalo had many things of similar character, secured some time before the operation of the Paris fountains, through the courtesy of M. Paulin, full detail plans of this most important installation. A study of the plans revealed much in comon between the Howard Tower and the Paris fountains. The writer prepared for comparison a plan to scale of the elevation, and a cross section of both these organizations for the purpose of creating out of the proposed Howard Tower water display some original effects or improvements on the Paris display. (See diagram, Fig. 23, which shows to scale the relative proportions, more particularly in the two niche spills.) This was, however, only partially carried out, the limitations of structural conditions preventing. Provision was made for the illumination of the

FIG. 24.—PAN-AMERICAN, GRAND COURT FOUNTAINS.

water display incidentally. Owing to changes that were introduced and lack of apparatus, the results were not attained that had been intended. The results attained (Fig. 24) do not show the capabilities conceived and planned for this work. However, the work now possesses more character than on earlier operation. Notwithstanding recommendations to avoid vertical streams in the tower basin, they were introduced, thus proving that design must sometimes give way to utility. The vertical streams were abandoned, owing to the drifting spray becoming a nuisance to surrounding walks. All the streams were finally turned inward. With the ultimate increase of water, they now possess more character and are more effective than heretofore. The detailed description of the Pan-American fountains will form the subject of a special article.

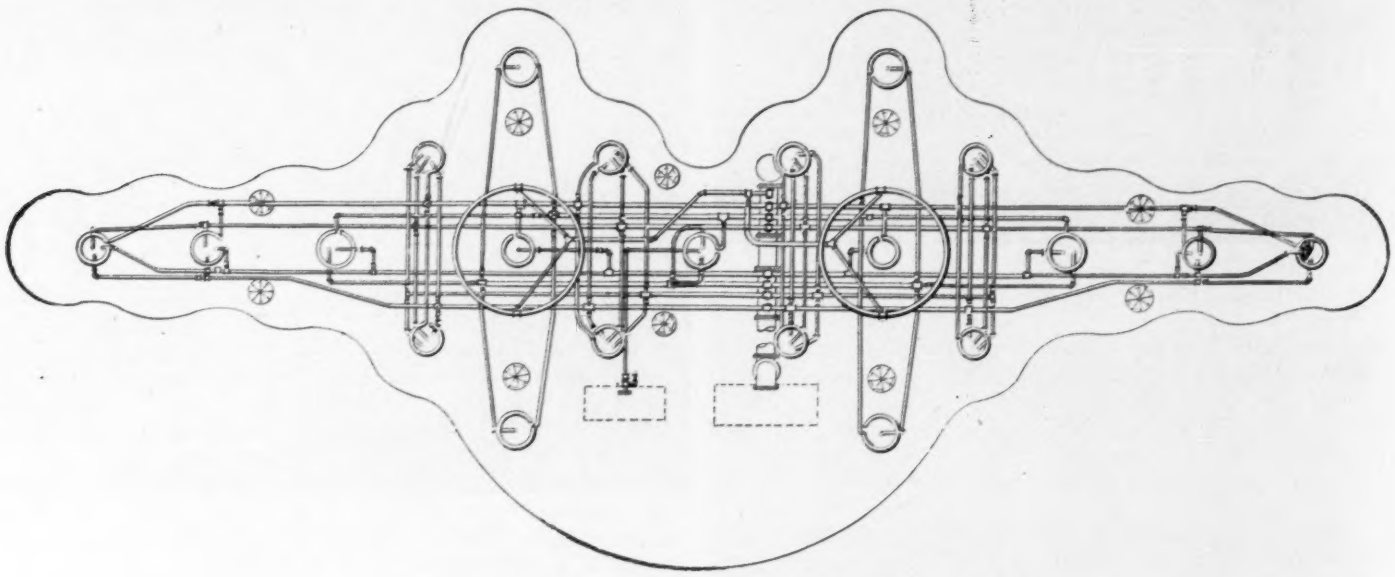


FIG. 25.—PAN-AMERICAN ELECTRIC FOUNTAIN PIPING PLAN.
(From Designs of Luther Stieringer, Consulting Engineer.)

The main flow of water at Paris issued from the ornamental niche into a basin and was intended to be of large volume. In its fall it assumed a cataract form. From the cataract basin it descended over a series of cascades. In the basin of the foreground a large number of fountain jets were placed. These were illuminated at night from chambers beneath. There were some 6000 incandescent lamps used in color and with commutating devices. The cataract, or main fall,

as originally planned, was destined to become a failure. The plans were changed from having the water spill over the basin ledge in a solid sheet to a series of internal terraces within the orifice or opening over which the water flowed; by this means creating an appearance of being expelled in great quantity. The same defect of cataract form would have resulted for the Pan-American Howard Tower niche, but fortunately the need of rearrangement was early indicated by a kindergarten model, which sufficed to suggest the changes finally made and the provision of more water than originally conceded to be necessary to fill out the orifice or opening to produce the effect of a surging and active release of a large volume of water. This was attained as now operated by a steel shield of a dustpan form, the handle end downwards, a header placed at the bottom from which a large number of streams are directed against the hollow of the pan or shield, which deflects the water outward through the semi-circular orifice. The vertical streams are provided with shut-offs to regulate the flow of water.

The motive assigned for the Pan-American Electric Tower water display was to convey the idea of majesty and abundance associated with Niagara Falls. Although the Paris design preceded the Pan-American arrangement, no motive was assigned of a source of water. The source was the River Seine, and the water in this instance was not alone offered for display, but was utilized in condensing steam.

The luminous fountain of the Pan-American Exposition shown in Figs. 25 and 26, is a duplicate of the Atlanta fountain, and by the same designer. The changes consist of two additional light shafts on the longitudinal axis, a motor and pumps located within the fountain chamber, the pressure being at best but 35 lbs. on all but the center stream, where 100 lbs. pressure is claimed. The electric generators that supply current to the motors driving the pumps are located in a small structure on the bank of the bay. The fountain has a superior setting in the center of this bay, the banks of which are well covered with trees and slope gently to the water, forming a natural amphitheater. These conditions make the surroundings appropriate for an acceptable performance. If the designs of this fountain could have been carried out in full, its inherent capabilities were expected to make it one of the features of the Exposition. The delays in material and other limitations have prevented the realization of the original conception. In being operated over an hour at a time, it has lost its novelty as an effect. As such it could not be operated successfully for a period of more than 12 or 15 minutes, and give a perfect entertainment. Fountains, like many other things, require rehearsals. This fountain was never thoroughly rehearsed and adjusted, but is still experimental. Even as operated, however, it is received with favor.

In considering the illumination of the world-famed Whirlpool Rapids of Niagara, one cannot but remark its resemblance to fountain work. The rapids form a natural wonder, and have a volume of water that no artificial source can ever mimic. These wild, fascinating, tossing waters were first illumined by the writer in 1897, during the meeting of the Edison convention at that place. More recently an installation of a more permanent character has been made for illuminating displays during the summer months. The display approaches closely to an electric fountain display, the water being continually in action, no repetition of form being produced, the effectiveness of the display depending only on the treatment by light in the illumination.

From the experience of this and other expositions, it is clearly evident that the success of an elecric luminous fountain, considered largely from the point of a spectacular display, depends chiefly on a suitable site and a dark environment, two conditions which are absolutely essential to success. And in conclusion, it may be incidentally remarked that the operation of an electric fountain in a location such as that described for the one at Prospect Park, Brooklyn, is not unlike an attempt to play a symphony on Broadway, New York, during heavy traffic hours. No matter what a fountain in such a location might be or is, the spectators, whom it is desired to please, lose the benefit of desirable surroundings. If the audience is not gratified, the chances are that the fountain will be scored a failure.

It will be evident from the above brief recapitulation of leading features in the history of electric fountains, that the development has been quite evolutional, but any one who has had to deal with exposition work must realize that to satisfy future requirements something absolutely new is required. After 100 years of expositions and at least 50 years of well-nigh uninterrupted attempts in that kind of advertising, it is evident that they no longer meet a want in the way of enabling the public to become acquainted with what is latest and best in any art or industry. This work is now done very satisfactorily by the daily and the technical press, as well as by the magazines, while each city of any size is itself likely to contain as good a display in any line as can be brought within the four walls of an exposition building.

There was extremely little that was new, industrially or technically, at Paris in 1900, and it might be questioned whether there was a single new thing of first-class merit at Buffalo that could in anywise compare with the faint whisper of the telephone at the Centennial in 1876 or the gleams there of the first successful arc lighting. Thus expositions tend more and more to the development of the spectacular and are becoming, unfortunately, over-ridden by the Midway feature. There will doubtless be great expositions in the future, but if the above statements be conceded to be true, as they must, it will be seen that the public will look for a greater accentuation than ever of spectacular displays such as are secured in electric fountains, electric towers and the like. It would hardly lie in the writer's mouth to claim that when the Pan-American has passed away it will be chiefly remembered for its nocturnal pageantry of light, but if those who have written about the show and described it are to be believed this will undoubtedly be the case. Possibly such expositions as that projected for St. Louis will present striking attractions during the daytime, but it is safe to say that special stress will be laid upon illumination and all that may be considered under that generic head. Electricity will certainly be adequate to this new task, for the resources of that inexhaustible and protean art have as yet been barely grasped even by those who have made it the study and work of a lifetime.

Novel Church Lighting.

A few Sunday mornings ago it was so dark at Stratford, Conn., that light was needed for the service in the old Congregational Church. Unfortunately, there is only a day circuit, and so the incandescents could not be used, and it was proposed to fall back on kerosene. At this juncture F. C. Beach, editor of the *Scientific American*, rode up to the edifice in his automobile and offered his services to help the commitee out of their dilemma. Mr. Beach placed his carriage near a window of the church, connected the Gould storage batteries to the circuit and soon had the darkened interior of the church brilliantly illuminated. At the conclusion of the service the wires were disconnected, and, mounting the seat of the vehicle, Mr. Beach ran it around to the front of the edifice and conveyed his family to their home. But few of the members in attendance at the service were aware of the unusual conditions, believing that the current which lighted the church was furnished by the Bridgeport company, as usual.

Trolley Network on Long Island.

Articles incorporating the Northport Traction Company, Long Island, have been filed with the Secretary of State. It is proposed to build and operate a street surface electric road three miles long, between East Northport station, on the Long Island Railroad, and Northport harbor, in the village of Northport, Suffolk County. The capital stock is $50,000, consisting of shares of $100 each. Directors for the first year are: William H. Baldwin, Jr., William F. Brown, and William J. Kelly, of Brooklyn; Frank E. Haff, of Long Island City; John Wolf Hiltman, Edward Pidgeon and Edward Thompson, of Northport; William E. Potter, of Flushing, and Frederic C. Scudder, of Babylon.

The incorporators include executive officers of the Lond Island Railroad, its president, secretary, general superintendent, solicitor, etc., and the organization of this company is a development of President Baldwin's policy of meeting competition from electric lines, which at one time promised to cut heavily into the passenger traffic of the Long Island Railroad. To anticipate this possibility Mr. Baldwin has adopted the plan of organizing electric companies at strategic points, and building short lines from stations on the Long Island Railroad to towns not on the line, where the business to be developed justifies the action. Thus the company owns an electric road at Huntington and at Far Rockaway, and will add to these lines from time to time. Experience in their operation will be useful also in anticipation of the introduction of electricity on the main line and divisions in the suburban zone about New York.

High-Speed Electric Railway Car of the Allgemeine Elektricitats Gesellschaft, Berlin—I.

BY O. LASCHE.

(*Chief Engineer Allgemeine Electricitats Gesellschaft.*)

THE high-speed electric railway car of the Allgemeine Elektricitats Gesellschaft, Berlin, is now ready to be placed upon the track and subjected to actual running trials. A stationary test of the car upon rollers in the factory has been made, and the operation of it under these conditions has fully answered all expectations.

The studies and experiments of the association for studying electrical high-speed railways have, up to the present, assumed but a general character, and do not refer to the equipment of any particular line. It is intended to begin within a short time the trials on the military railway track Berlin-Zossen, which has been kindly placed at the disposal of the association by the Imperial Railway Military Board of Administration.

The speed of 125 miles per hour has been assumed as the maximum velocity because of the present construction of the car, but it must not be inferred that the main object consists in the attainment of that speed or that there will not be any possibility of making the trials at a still higher speed. The trials, however, have for their special object the establishment of a sure basis for projecting, constructing and working *electrically* lines at speeds which are common at the present day, or still higher. In technical journals and newspapers the speed of 125 miles per hour has been ridiculed as impossible of attainment; on the other hand, it has been often asserted that this speed can be reached by steam locomotives, Americans claiming, as is known, to be able to travel at a still greater rate. In view of the present requirements of traffic, efforts must, of course, be made to travel faster, but especially must traveling be made more convenient for the public, and for this purpose electricity is best adapted. Of course, the object of the present trials and of the operations during the next few years will be to ascertain the economy of an electric system of working as compared with the present steam working system. It must be ascertained in what proportion the total costs stand at different velocities and especially at the higher velocities. Cost was not considered the main point when electric light and electric power were introduced, and even up to the present day the electric light is often much more expensive than other forms of illumination, yet electric lighting occupies a very wide field of activity. In the same manner cost will not be the first consideration in the introduction of an electric system of working existing railways, but rather the convenience afforded by such a system. From this beginning the introduction of electric long-distance traffic will be easily developed and become universal.

A rapid succession of separate motor cars is one of the most obvious advantages of an electric system of railways, and this method of working is proposed both for suburban and long-distance lines. For this reason, therefore, the trial cars of the association have been built as passenger cars and not as locomotives. This quick service system is already needed for the convenience of the public and will be gladly paid for by them.

Lines with an increasing traffic will appreciate the advantage of introducing an electric system of working, as with such a system it will not be necessary for them to strengthen either their tracks or their bridges, since instead of meeting the increasing traffic with heavier locomotives and longer trains, a quick service system of light and separate motor cars can be introduced, with the additional advantage of freedom from smoke annoyances.

The track and its maintenance are, of course, very important points in a high-speed electric system of railways, and many considerable improvements will be necessary, although the trials shortly to be made will prove the comparative requirements of electric motor cars and steam-driven trains.

The coming experiments are expected to establish a basis for the calculation of the working expenses of electric main lines, the outputs of motors for the various speeds with the increasing influence of the air resistance, and for the size of the necessary power station. Of the limit of the minimum speed at which the electric system may be more economical than the steam locomotive system, about as little is known as the limit of the maximum speed. It is only known that with steam locomotives the consumption of steam and especially the consumption of coal is largely increased as the speed grows. By centralizing the generation of power the case will, of course, be entirely different. The best large steam engines may be used, and boilers with superheating and feed-water heating apparatus. This centralization is possible for very long distance lines, and consequently also the attainment of a practically uniform load.

Electric energy may be economically transmitted to very long distances by three-phase alternating current at 40,000 to 50,000 volts and further extensive railway systems can be supplied with energy from a central station placed in the most favorable situation.

CHOICE OF THE SYSTEM.

Owing to the long distances through which it may be necessary to operate, the system to be adopted is three-phase alternating current of high potential. For the present experiments a voltage of only 10,000 to 12,000 is necessary. The current is supplied by the Oberspree Central Station of the Berlin Electricity Works, the distance from the station to the point at which the overhead line is fed being about 15 km. Transformers are mounted in the car by which the voltage impressed upon the motors is reduced to 435 volts.

As to further constructions, it remains an open question whether it is advisable to keep the heavy weight of the transformers within the car. It may be preferable to reduce the high tension of 50,000 volts by transformers placed in houses alongside the track to a medium tension of about 3000 volts and to wind the motors for this voltage.

The transformation of three-phase currents into direct current is not practicable for feeding long-distance railways, since it necessitates the use of motor-generators or rotary converters which require attention. Furthermore, the direct-current system can be used only at low voltages and therefore transformer stations are required at frequent intervals along the line to avoid excessive losses. It may prove necessary to use direct current where the long-distance motor cars pass through cities. The overhead wires required by the three-phase system are inconvenient for branches and switches, and therefore it may be necessary in such cases to shunt a low-speed locomotive operated by direct current in front of the car.

The problem set to the Allgemeine Elektricitats Gesellschaft was to construct a motor car for a speed of 125 miles per hour, and to accommodate 50 persons. The car has two bogey trucks with three axles each, and the motors are designed for a total normal output of 1100 horse-power and 3000 horse-power maximum. The electric current provided is three-phase, at a tension of 12,000 volts, and with a frequency of 50 cycles per second. The weight of the cars was required to be as small as possible, and by no means to exceed eight tons per wheel; and the cars were required to conform to certain dimensions to pass over the lines of the State railway.

The car cannot be compared in any way with the ordinary tram car or low-speed locomotive, its electrical equipment including the motors, transformers, and the starting and regulating arrangements, being of an entirely new and novel construction. It has been built, however, in such a fashion that after the experiments on it have been carried out it can be put into actual working use.

In order to obtain the lightest construction of car and of the electrical equipment a long series of experiments and designs were made before the final form was adopted. In view of the desired high speed the A. E. G. thought it necessary to find means to relieve the axles from the heavy weights of the motors, or at least of preventing the axle from being directly burdened by this weight.

The starting and regulating apparatus for 3000 horse-power could not be constructed according to the types of the usual car controllers having to deal with an output of hardly 100 horse-power. Elaborate and costly experiments were necessary for testing the entirely new constructions which were designed.

The braking at a speed of 125 miles per hour by means of friction brakes, that is, at a friction speed of 56 meters (183 ft.) per second, was found impracticable, and it appeared necessary to provide means for braking electrically as well.

Quite a number of further new details had to be designed. The motor bearings have to work at a speed of about 14 meters (46 ft.) per second, the slip rings of the armatures at a speed of 40 meters (157.5 ft.). The trolleys constitute another new detail, which may be considered as one of the most difficult problems to be solved.

WEIGHT OF THE ELECTRICAL EQUIPMENT.

As to the arrangement and especially the designs of the body of the car, at first it was proposed in view of the conditions of running in both directions, forwards and backwards, to construct at

each end of the car a driver's cab, in which the necessary starting apparatus was provided. The construction was so arranged as to enable the driver to control the entire electrical equipment of the car from the front starting device. This arrangement, however, proved impracticable, owing to the quantity of cable required, considering that 3000 horse-power had to be controlled. Matters were facilitated by dividing the electrical apparatus into two circuits and operating the rear starting device at a distance, either by an electric motor, compressed air, or water pressure.

In one design considered, the working compartment was of two stories, the lower one for the necessary apparatus and machinery,

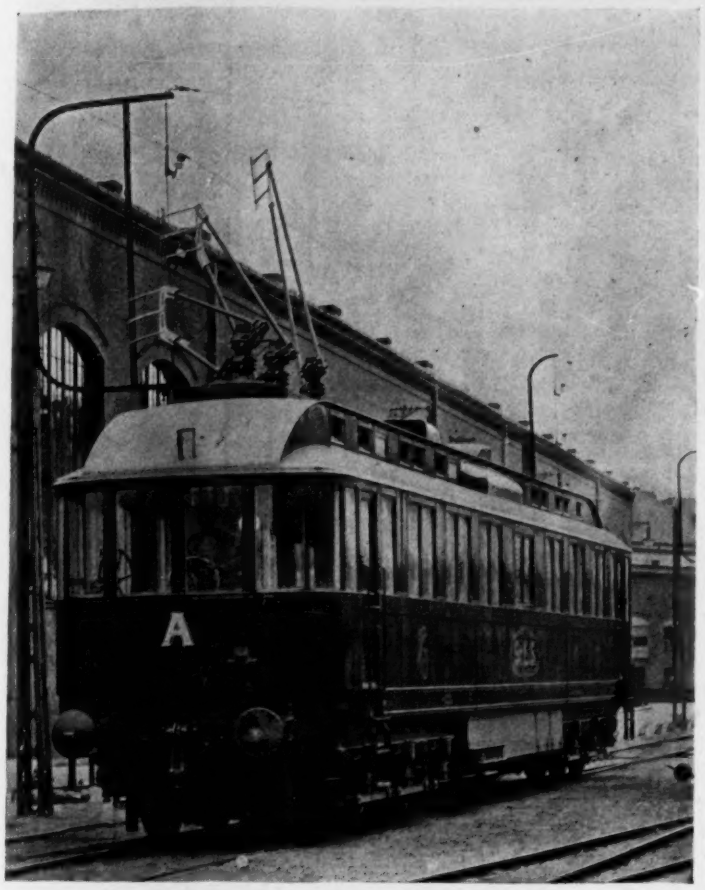


FIG. 1.—ZOSSEN A. E. G. CAR.

and the upper one for the driver and the starting and regulating apparatus. These arrangements prevented the driver from inspecting the track within 30 meters (98.4 ft.) of the front of the car, and although such inspection is of no great use in consideration of the high speed at which the car is to travel, yet the design was altered and a driver's cab provided at each end. It is especially desirable in consideration of the high speed of the car, which would make a side lookout very trying to the eyes, that the public should be provided with a lookout at the ends of its body, and therefore, although there is a cab at each end, it is so arranged that lookout windows are left. These conditions led to the design of car shown in Figs. 1, 2, 13 and 14.

All apparatus, cable and safety devices are arranged in the space in the middle of the car. This room, and also the transformers built below it, are separated from the passengers' compartments by air shafts having double iron walls. The driver always stands at the front of the car, apart from the passengers, in a room containing no parts under high voltage. The controlling is effected from the cab by a system of mechanical transmission.

It has already been stated that the transformers had to be mounted in the car, although their weight is extremely inconvenient and considerably increases the total weight of the motor car.

In the calculation of the transformer windings and the cross sections of the iron, the question of the heating of these parts and its dissipation is of the greatest importance.

The cooling of the transformers by air taken from below the car is impossible, on account of the great accumulaion of dust when traveling at a high speed. On the other hand, the designs showed the great difference in the weights when air is passing *through* the cores of the transformers in contrast with the insignificant cooling obtained when only *over* the surface of the casing. Two air shafts are led from the roof of the car to the transformers in such a manner that the front shaft is used for admitting fresh air and the rear shaft as an outlet for the heated air. Special care has been taken for shielding the motor from the air in rainy weather and for drying and filtering it before it enters the channels of the transformers, although actual contact of the cooling air with live circuits is avoided.

Further economy in weight resulted from the use of a liquid starting device of an entirely new construction, instead of a metal starting device with coils or strip resistance material, such as was at first provided.

The following brief summary shows how the weights varied in the different investigations:

Weights.	I. Pounds.	II. Pounds.	III. Pounds.
Four motors	37,274	35,274	28,218
(a) Two transformers	28,660	28,660	14,330
(b) Starting resistance with casing	19,841	19,841	10,471
(c) Two controllers with driving mechanism			
(d) Braking and lighting batteries	5,732	5,732	5,732
(e) Motor with compressor	1,763	1,763	1,763
(f) Oil pump	441	441	....
(g) Oil tank	1,322	1,322	....
Total weight of cable	8,818	2,204	2,204
Collector bows	3,086	3,086	3,086
Summary	104,939	98,322	65,808

The final weight of the transformers was 6.5 kg. (14.3 lbs.) per kilowatt, and of the motors 13 kg. (28.6 lbs.) per horse-power of the normal output and 4⅓ kg. (9.47 lbs.) per horse-power of the maximum output. The table also shows the economy which resulted from the construction of the motors (Fig. 3), without a closed casing. As with the new types of alternating-current dynamos and stationary motors, the iron of the magnetic circuit is not covered by the usual casing, but is directly exposed to the air, the cooling surface of the motors being enlarged by the provision of ribs. The surface cooling is therefore very excellent and fully sufficient for the continuous running of the motor. There is no provision made for the admission of air into the motor, as on account of the dust it is not possible to take the air from below the car, and the supply of air from above could only be arranged in a very inconvenient manner.

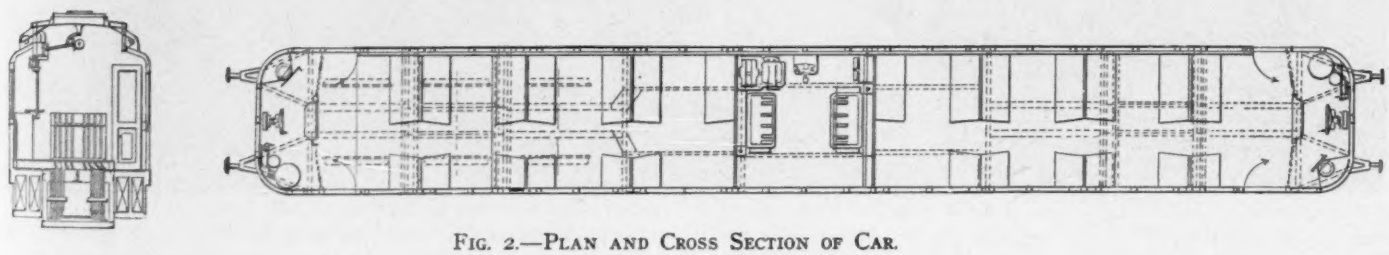


FIG. 2.—PLAN AND CROSS SECTION OF CAR.

STARTING DEVICES.

In the remarks concerning the main division of the car and arrangement of the electrical apparatus having regard to the attainment of the smallest weights, it was mentioned that the starting ap-

paratus was mounted in the middle of the car so as to shorten the cables as much as possible. The primary circuit of the motors is provided with a switch for reversing the direction of running, for cutting out and for braking the motors by counter current, or by connecting the circuit of the field frame to a storage battery.

The problem of the starting resistance for 3000 horse-power was finally solved by a liquid starting device on quite a new principle. Fig. 4 shows the corresponding experimental arrangement. A three-phase motor of 200-400 horse-power is coupled direct to a very heavy flywheel. For making this run up to full speed in 15 seconds a torque corresponding to an output of 400 horse-power must be attained. With the same output, another heavier flywheel is made to run up to full speed in 1½ to 2 minutes. The former meets the requirements of a hauling engine, the latter the requirements of the high-speed car. The high-tension switchboard is arranged in the background, wherefrom the winding of the motor is connected for backward and forward motion. A combination of these connections with the starting device proper was omitted in this experimental arrangement.

The cut shows in the foreground a small centrifugal pump driven by an electric motor, which withdraws the liquid from a tank located in the basement and continually delivers it into the superposed tank in which the electrodes, i. e., the terminal or end plates of the opened armature circuits, are located. The pump operates continuously, hence a continuous renewing and mixing of the liquid takes place, the electrodes are thus suspended, not in stationary, but in moving water. By shifting the somewhat primitively arranged vertical rod to the right, a valve located in the bottom is closed, through which, when open, the water is continuously discharged. The liquid now begins to rise in the tank, i. e., the armature circuits are closed, whereby a considerable resistance remains switched in. The motor starts, as the liquid rises further the interposed resistance decreases and the motor runs quicker. Consequently, for a certain load of the motor each height of the liquid level represents a certain speed. By means of a regulable overflow in the electrode vessel, the level of the liquid, and consequently the speed of the motor can easily be adjusted.

The electrode plates are at the lower end, very wide apart, and made with prongs of different lengths. The arrangement is such that the longest prong of the first plate is situated diagonally opposite to the longest prong of the other electrode. Thus at the beginning, not only is the dipping surface small, but especially the distance or the path of the current through the liquid, is very long. The immersed surface of the plates can therefore be considerably larger on account of the great distance than might be the case for the passage of the same quantity of current through a short path, i. e., the specific passage from one plate to the other of the current through the liquid is reduced. In consequence thereof a flashing of the points or tips such as occurs with the old construction has become impossible. On the other hand, the electrode plates are put very close to each other at the top, and besides, more plates are used in order to keep the current conducting surface very large, thereby reducing to a minimum the resistance set up by the liquid to the passage of the current. It is thus not necessary to use metallic short-circuiting contacts.

The essential difference between the new starting device and the previous ones consists in keeping the liquid in constant motion, and this fact alone ensures its success. The heated liquid does not remain at the part where heat is generated, but is constantly moved and mixed afresh. It can be easily calculated what amount of heat is delivered to the liquid by the resistance at a certain load and a certain decrease of the normal speed. On the other hand, water in motion renders it possible to conduct away the troublesome heat in a very simple manner. The cooling surface necessary to do this may be calculated. For instance, according to the present construction

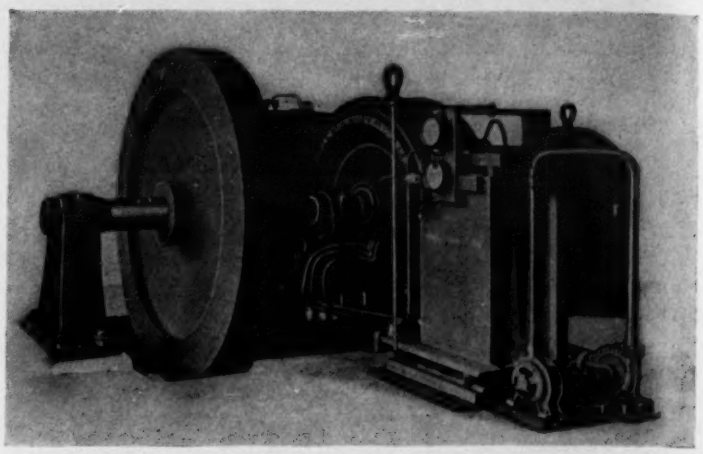


FIG. 3.—EXPERIMENTAL FORM OF STARTING DEVICE.

in the high-speed car, a copper coil of small diameter is provided, through which the heated water has to pass after its exit from the electrode vessel, and before it is used afresh. Consequently, the new liquid starting device enables any suitable large resistance to be introducd into the circuit permanently, i. e., the motor can continuously run at any desirable slow speed.

The starting time of the motor, viz., the time up to which the resistance is entirely cut out, is determined by the speed at which the liquid flows to the electrode vessel. By inserting an adjustable cut-off device in the pipe leading from the centrifugal pump, the speed at which the liquid is delivered and consequently the starting time can be regulated at will. By this construction it is therefore rendered possible to prevent the driver from reducing the time of the starting; hence the acceleration and consequently the momentum of inertia can never prove greater than the overloading capacity of the motor permits. On the other hand, the driver can, by a correspondingly slow or incomplete closing of the foot valve, decrease the speed for starting and braking, to any desired extent. In a similar manner, the driver can run the car at any desired slow speed by keeping the foot valve partially opened. Consequently, he can al-

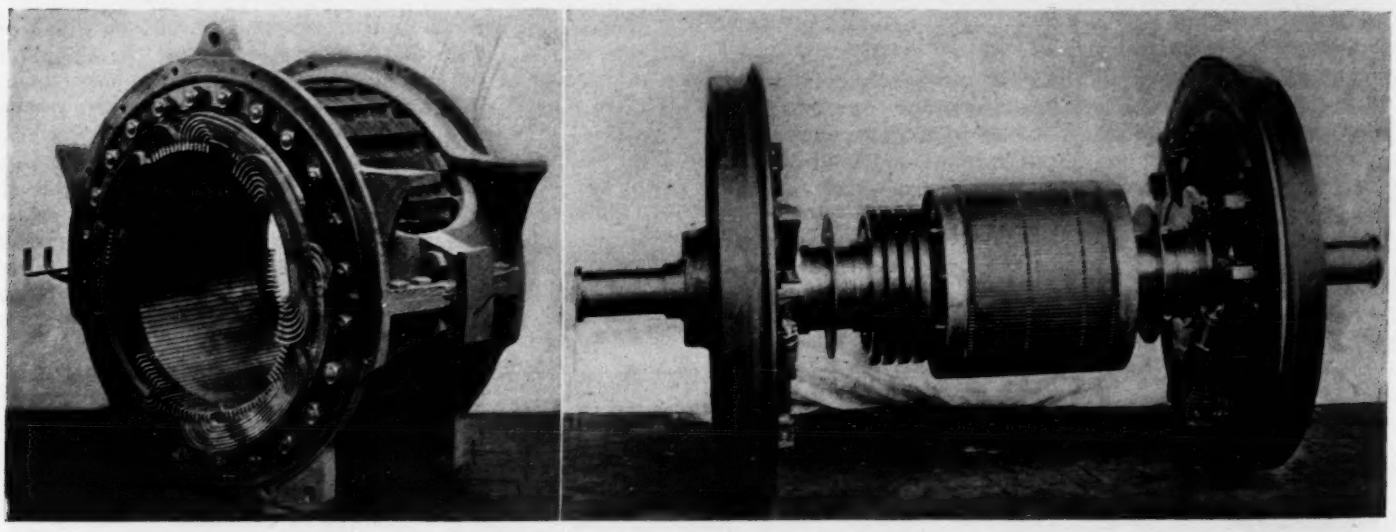


FIG. 4.—MOTOR FIELD AND ARMATURE.

ways regulate the speed. This new construction, when compared with metallic starting devices, also shows the great advantage of a gradual and perfectly regular switching out of the resistance over the intermittent action of the latter. In other words, the starting and braking are effected softly and not by jerks. Any one who has experienced the jerking motion in tramway cars can realize how the above arrangement will be appreciated by the passengers.

Owing to the great simplicity of the apparatus, it can always be readily operated from remote points, as the power required is very small. Consequently, the provision of compressed air or electricity in the car as means for operating the reversing mechanism is obviated. It has only been necessary to provide a connecting shaft operated by a hand wheel from each or both drivers' cabs.

By employing this new system of liquid starting apparatus, metallic resistance was no longer needed. Several hundred contacts and connecting cables were dispensed with, and as regards maintenance, all fear is needless, since the maintenance of plates immersed in a soda solution, and therefore not liable to get rusty, cannot be compared with the maintenance of many and large controller cylinders, contacts, contact brushes, cable connections and pieces of resistance material.

BRAKES.

With the same experimental arrangement constructed for testing the starting apparatus, the system of electrical braking by the motors was also tested.

The car is equipped with a Westinghouse compressed air brake, which is divided into two parts for each of the two trucks. The compressed air cylinders are operated from the front driver's cab. The brake pressure is assumed as very high, 170 per cent, because the friction coefficient between brake block and wheel at the high speed of over 50 meters (164 ft.) per second is materially different from the friction coefficient at the usual lower speeds. In consequence of investigations made, an appliance has been devised for decreasing the brake pressure at a gradual slow speed. Notwithstanding the fact that in a certain degree the brake device of the one forms the reserve for the other bogey, it was not considered admissible to dispense with a second brake device. This additional braking action was imparted by the motors themselves, and not by special rail brakes or similar less proved apparatus.

The braking or retarding action can be effected by means of an electric motor in two different ways: First, by eddy current, namely, energizing the field of the motor with direct current and short circuiting the armature; and, second, by reversing the direction of the current in the rotary field.

Both kinds of brakes are used in the high-speed car. After the armature circuit is opened by opening the outlet valve on the liquid starting device, the field is cut out and switched on to a storage battery built within the car, or is reversed to opposed current in that two of the three phases are reversed, the series arrangement of the phases being changed from 1, 2, 3 to 1, 3, 2 and 3, 2, 1, respectively.

After the switching has been effected in either way, the armature circuit is gradually closed again, i. e., the inflowing liquid connects the phases through very great resistance; and according to the desired intensity of the braking action, the level of the liquid is raised or lowered.

The braking with counter current alone did not appear to be sufficient, because the current was liable to fail for some reason or other, for instance, by the blowing of a safety-fuse in the very moment when the brake is applied. The use of counter current has a further disadvantage. In conformity with the electric dimensions of the motor and the potential of about 430 volts selected for the field, the armature has a tension of about 325 volts with open circuit. After the reversal of the field, the tension in the armature increases at the full speed of the latter, to almost double the amount, viz., to about 650 volts. Although the liquid starting device is constructed for this voltage and the motor armature also fully sustains the same —it was tested at 4000 volts—yet it does not appear proper during the braking action, when there is a possibility of direct danger, to make the safety of the braking action dependent on an unusually higher voltage.

These were the reasons which led to the provision of an eddy current braking system, and for this purpose there were also used, analogous to the two separate air receptacles for the Westinghouse brake, two entirely separate storage batteries. It is here assumed that motor braking must be made use of in the event of the high speeds, whereas the air brake is only applied at the end of the run. For shunting service a hand brake is provided, which acts on the front bogey.

The Induction Motor for Electric Railways—I.

THE paper read at the recent Buffalo Convention of the American Institute of Electrical Engineers by Mr. Ernst J. Berg, entitled "Electric Railway Apparatus," and another by Mr. Albert H. Armstrong, entitled "Notes on Modern Electric Railway Practice," are of particular interest for the discussions contained of the status of the induction motor in electric railway work.

The paper by Mr. Armstrong discusses the best accepted practice for several classes of railway systems from the direct-current standpoint, and then takes up the subject of alternating generation and transmission, with induction motors on the cars.

This system is briefly defined as consisting of a polyphase generating station supplying transmission wires extending along the line of travel, feeding at frequent intervals into step-down transformers which reduce the transmission potential to a still considerable pressure for the overhead trolleys. Induction motors receive their power directly from these trolleys and are geared to the car axles by the standard method.

A principal advantage of the induction motor system lies in the reduction of the labor account due to the elimination of attendance at the sub-stations, the step-down transformers being self-cooled and requiring no more than casual inspection. Where the train service is infrequent and does not justify the expense of sub-station attendance every 12 or 15 miles, the induction motor system offers a substitute to the converter system worthy of very careful consideration. As the induction motor system introduces several features which are new, viewed from a direct current standpoint, a few of its characteristics are touched upon.

The induction motor, while not a synchronous piece of apparatus, is such so far as its behavior in railway work is concerned. A car equipped with such motors will run at practically constant speed up grade and down, or on level, thus making the car speed nearly independent of the profile of the road. The speed of the induction motor, depending upon the frequency of the source of supply, is not affected by the voltage, provided the voltage is sufficiently high to provide the torque required. This constant speed quality of the induction motor at first sight appears to be a desirable feature, as it would seem to ensure the maintenance of a constant schedule speed not influenced by grades. The greatest objection, however, is that the practically constant speed of the induction motor car up the severest grades calls for a very large motor output and produces much more violent fluctuations upon the distributing and generating system than is the case with the d. c. series motor, which falls off considerably in speed on heavy grades. The system, being alternating throughout, provides no means of introducing storage batteries to smooth over these excessive fluctuations, and they are more liable to reach the generating station and produce an irregular load curve with its greater coal consumption than is the case with direct current series motors and rotary converter sub-stations, even though this may be used without storage battery auxiliaries. Where the system is so extensive that each individual car or train is a small increment of the total load, this objection of fluctuations upon the generating station will, of course, not hold true. The motive power, however, must provide for the running of the car or train up the steepest grade at practically the same speed at which the car operates upon a level, and the motors must therefore be designed to stand a greater output for the same service performed than the direct current series motor.

The induction motor can give only a certain maximum torque with a given impressed line voltage, and as this torque decreases with the square of the impressed voltage, it will be necessary to carefully determine the operating conditions of the motor and of the distributing system in order that the motor may be able to start its car or train upon the heaviest grade with the minimum line potential met with in operation. The direct current series motor can give a torque much in excess of any service demand, without sacrificing its running qualities at light loads. Railway service calls for a large overload capacity of its motive power, and the induction motor can meet these infrequent demands only by a design which sacrifices some of its advantages for normal operation. For example, a motor car to be successful must be able to operate through snowstorms, oc-

casionally haul a trailer, or push in a disabled motor car over the irregular profile of the road. An induction motor car designed to provide just sufficient torque to operate itself alone, would fail to give the commercial satisfaction which is given by the direct current series motor car with its capability of standing enormous overloads for a short time. It is evident that the practically synchronous operation and limited torque of induction motors introduce a number of problems into high-speed interurban work not met with in direct current distribution, and that the motive power, transformer sub-stations, distributing system and generating system must all be designed very liberally in order to take care of the violent and large fluctuations inherent in the operation of the railway induction motor.

The induction motor, like any piece of alternating apparatus, demands a magnetizing current, and this current is much larger than that met with in stationary motors, due to the larger air-gaps demanded in traction work. Stationary motors can run at air-gaps of but three or four-thousandths of an inch, but the railway man would decline to assume the responsibility of keeping up his bearings for any such air-gap. Increasing the air-gap will raise the magnetizing current, lower the power factor of the system, and hence increases the size and cost of the distributing and generating apparatus. The necessity of designing the railway induction motor to meet unusual demands occurring very unfrequently further increases this magnetizing current, due to the high density required in the iron circuit with a reasonable motor weight. Even with a liberal air-gap, viewed from an induction motor standpoint, such a motor demands a clearance between field and armature nearly 50 per cent less than is common practice with d. c. motors. The maintenance of linings with a small gap is a matter for consideration, particularly when it is remembered that when the armature of an induction motor strikes its field, it may destroy two sets of windings as the field is a duplication of the armature winding. We are therefore confronted with the maintenance of an air-gap of half the width and double the expense of repair with the induction motor to offset the small commutator maintenance of the d. c. motor.

The installation of high-speed interurban roads in this country has been brought about by the financial success of the earlier roads of this character. Because a system is operative is no reason for its adoption unless there is sufficient promise of its superiority over present methods. Our interurban and suburban roads possess a very strong advantage in being able to traverse city streets en route and at their termini. All the large cities in this country, and most of the smaller ones, have direct-current railway systems in operation, and the direct-current interurban and suburban system can therefore run its cars over existing city systems without in any way conflicting with the operation of such roads. The induction motor interurban system, on the other hand, would necessitate the changing of cars at the outskirts of the termini cities, running around the cities passed en route, or else the equipment of unused streets with double trolley and alternating current; or as an alternative, changing over the generating and distributing system and motive power of all cities entered, to alternating current. There are a number of engineering difficulties to overcome before such a change would be commercially practical.

A chief advantage of the induction motor system lies in the ability of running motors from trolley potentials far in excess of 600 volts universally used with direct-current series motors. Not having any commutator, the induction motor can use trolley potentials of several thousand volts, and proper line insulation and safety in operating are the only limits placed upon the trolley voltage. Owing to the large lagging currents demanded by induction motor roads which operate at power factors ranging from 50 to 75 per cent, it is desirable to use as high a potential as possible in order to eliminate the excessive feeder copper or frequent transformer sub-stations required with low voltage distribution. A trolley potential, therefore, of 2000 or 3000 volts offers advantages in interurban distribution well worth the extra expense and development needed to insulate trolley and car wiring at this comparative high potential. In order that the motive power will be reasonably cheap, and bearing in mind that such motive power must stand maximum demands considerably in excess of the direct-current motor, it is advisable to wind the motors directly for the trolley potential rather than introduce the expense and provide space for step-down transformers. We are therefore confronted with the difficulty of running a 3000-volt trolley through small cities along the route and into large cities at the termini, even assuming that the cost of changing over such systems to alternating current would be justified.

Step-down transformers installed upon the car, reducing from 3000 to 600 volts, open the possibility of running motors without step-down transformers on city streets, and with step-down transformers when the trolley potential is 3000 volts in the open country. The double trolley, however, complicates the city system and adds additional expense to the already expensive motor equipment. The induction motor, moreover, is not adapted to city street running, calling as it does for constant acceleration and efficient operation at fractional speeds. Instead of efficiencies of acceleration in the seventies obtained with direct-current motors, the induction motor would give an efficiency of only 40 to 45 per cent during acceleration with a corresponding increase in coal consumption, making it compare very unfavorably with the direct-current motor for city work. The adoption of the induction motor for interurban work seems limited, therefore, to those roads running on private right of way throughout, and having no connection with existing city systems at their termini or en route. Even in this class of roads, if the service is at all frequent and profile very irregular, the direct converter system with its third-rail distribution may prove cheaper to install and operate. The reduction in operating expenses which the induction motor effects by dispensing with rotary converter sub-station attendants may be more than offset by introducing apparatus whose volt-ampere capacity may be double the kilowatt capacity required, and which furthermore may operate with a very irregular and inefficient load curve as compared with the load curve produced with d. c. series motors.

The above are stated to be a few of the obstacles in the way of the success of the induction motor for general interurban work. There are, of course, special instances where the roadbed is practically level, grades and curves being eliminated and the conditions ideal for the installation of induction railway motors. It is unfortunate, however, that all interurban roads cannot pick out a level country, or have unlimited capital at the back of them in order to provide ideal conditions for the motive power; in fact, the motive power must accommodate itself to the physical limitations of the road, and it is just here that the direct-current series motor shows its superiority to the induction motor where the profile is irregular and where the service consists of mixed city, suburban and interurban high-speed work. As before stated, interurban high-speed roads are being rapidly extended in this country owing to their economic success, and in a large number of cases coming under the writer's observation, the induction motor could not compete in first cost of installation, nor in expense of operating with the d. c. motor, operated from rotary converter sub-stations and high-tension alternating transmission. The expense of the few men required to operate sub-stations is a very small item in the total operating expenses of the road, and as our interurban roads more nearly approach steam practice, they require attendants every 10 or 15 miles to serve as ticket agents, train dispatchers, etc., so that with a well-organized interurban system, the item of sub-station attendance can be largely charged to the general operation of the road and not to the cost of producing power.

The ideal conditions for the operation of induction railway motors seems to be a regular profile, either level or a uniform up-grade, private right of way with no city or suburban running, infrequent service, and freedom from unexpected and fluctuating demands upon the motive power. Electric railway work up to the present has demanded considerable of the motive power in the way of meeting large momentary overloads, running at different speed, line voltage, etc., and the direct-current series motor has shown itself well equipped to meet these requirements. The induction motor is more adapted for operation under predetermined conditions, and its design does not lend itself to the same broad field of usefulness now covered by the direct-current series motor.

In a service calling for frequent stopping where the demand upon the motors is largely acceleration work, the induction motor must dissipate considerably more energy for the same service performed than the direct-current motor, and hence must be correspondingly heavier and more expensive. For constant speed running, the induction motor, however, must dissipate but little more energy than the d. c. motor, and from the nature of its design may dissipate that energy more rapidly.

This brings up a new class of railroad work just being considered, and that is mountain railroading, and long-distance cross-country roads for either high-speed passenger or freight work. The condi-

tions governing both these classes of work are practically the same in that they demand a constant sustained output of the motive power, and it is in this class of work that the induction motor is being seriously considered.

Direct-current motors fed from a system of rotary converters connected to a high-potential transmission distribution system are open to the objection that a trolley or third-rail potential under 1000 volts must be used, necessitating the collection of very large currents and an undesirable frequency of converter stations, or prohibitive expense of third-rail and feeder construction. The power consumed by a freight train of 2000 tons or more may reach 3000 horse-power on the grades encountered in steam railway mountain work, and the ability of the induction motor to collect this large amount of energy at a trolley potential of 3000 volts or more, gives it a distinctive advantage in first cost of installation and expense of operation compared to direct-current distribution. High-potential alternating trolley systems present certain difficulties in the way of insulation, but after several years' experience with high-potential transmission lines, these difficulties should be easily surmounted. Such systems also employ locomotives and not individual motor cars, so that the high-potential apparatus is localized, and more space is provided to properly insulate all high-tension wiring.

The operation of heavy freight trains, or high-speed passenger trains on trunk lines is the work of the future, and will be undertaken as soon as it is evident that a saving will result in operating expenses by the substitution of electricity for the steam locomotive. Trunk lines having local passenger traffic could very well equip their tracks with both high-potential overhead trolley for the operation of heavy through trains and freight work, and also use a third-rail construction to operate direct-current 600-volt d. c. motors for the short haul work. Both these systems could be fed from the same generator and transmission lines, operating 25-cycle rotary converters to feed the third rail system at intervals, and step-down transformers to reduce the potential to the 3000 volts or more required for the overhead high-tension trolley line. This mixed system provides for the maintenance of a steady load on the generating station, while it permits the local and short haul traffic to benefit from the advantages of the d. c. motor for this class of work.

The electrical equipping of trunk line steam roads is a very large engineering proposition, involving such radical changes in the operation of such roads that its commercial success must be undoubted before the work is undertaken. It is possible that such a movement will be brought about by the equipping of some of the new high-speed third-rail interurban systems with overhead trolley operating at 3000 volts alternating current. These systems are rapidly being extended and interconnected, and will soon be able to take care of long-distance work when the systems are sufficiently joined together. The management of such roads, owing to their experience with electric traction, may be reasonably supposed to be more open to the advantages of electric haulage, while the establishment of a line of generating stations, all operating at the standard frequency of 25 cycles, will offer the means of feeding such a system with a comparatively small cost for equipping. The various sub-stations, however, and the d. c. copper distribution are not adapted to the operation of large heavy units, although the transmission lines and generating stations could well feed these trains with a reasonable outlay for high-tension overhead trolley construction.

It is along such lines that Mr. Armstrong looks for the introduction of the induction motor as a railway factor in this country, and there are several propositions in view where the introduction of the induction motor seems justified and preferable to the steam locomotive now in operation.

An abstract of Mr. Berg's paper will appear in next week's issue.

A German Interurban Railway.

Consul Warner reports from Leipzig that work has been begun on the electric railroad between Halle and Merseburg, permission for the construction of which was granted by the Prussian Government several months ago. It is expected that the Halle-Ammendorf section will be completed before the beginning of winter. The total length will be 10 miles. Power will be obtained from the River Saale. The consul also states that the projected electric railroad between Leipzig and Halle has been abandoned, the Prussian and Saxon governments having refused to grant the necessary franchises.

Extension of the Snoqualmie Falls Plant.

The Snoqualmie Falls Power Company, transmitting to Seattle and Tacoma, is preparing to increase from 8000 horse-power to 20,000 horse-power. At present there are four 2000-hp units at the Falls. The transmission voltage is 30,000. The Abner Doble Company, of San Francisco, which furnished the waterwheel equipment for the initial installation, is figuring upon placing its wheels in the new extension, and an engineer of another waterwheel concern is likewise looking into the matter. The waterwheel contract will not be let for 60 days yet. If an impact wheel is used there will be a single wheel on each end of each 3000-kw generator shaft, and each wheel will be driven by a single jet of water 14 inches in diameter, the two jets combined being sufficient under the existing head of 270 ft. to give the requisite power. The two waterwheels and the generator between will be built on a single hollow shaft of oil-tempered nickel steel.

The present underground generating station, which is 200 ft. long, is to be lengthened out 150 ft. up stream, to make room for the new installation. A new penstock is to be built, which will carry 50 per cent more water than the old one. The transmission line that is to parallel the old line, will require 125 tons of aluminum wire, and the order for it has already been placed. At Tacoma a large and commodious brick and stone sub-station is now being erected. The entire cost of these improvements will be in the neighborhood of $400,000. The work is to be vigorously prosecuted, and it is expected that the first of the new generators will be delivering current into Seattle and Tacoma within the next nine months.

The generating machinery will consist of three 3000-kw rotating field generators of the two bearing type, generating a three-phase current at 1100 volts and 60 cycles. The speed is to be 100 r. p. m. Each generator will require an exciting current of 320 amperes approximately, at 125 volts. For exciting these three generators a 220-kw, eight-pole, direct-current generator of the two-bearing type is to be used. At 175 r. p. m. it is to deliver under normal load a current of 1600 amperes at 125 volts.

The current which is generated at 1100 volts is to be raised to a line potential of 30,000 volts by nine 1000-kw, oil-insulated, water-cooled transformers. These are to be delta-connected on both the primary and secondary sides. It is estimated that each transformer will weight 11,000 lbs., and require 500 gallons of oil. The switchboard that is to be installed is to consist of 14 panels of white marble and is to be of the special type that was furnished for the original installation. Instead of the Niagara type single-phase indicating wattmeter that is in use on the present switchboard a polyphase long scale indicating wattmeter is to be used. Where formerly a field plug switch was used a double-pole field switch is to be employed. The standard equipment of synchronizing lamps is to be replaced by a single-pole plug switch mounted on the generating panel and connected to a synchroscope, which will be mounted on the multiplying panel. The increased capacity of the generators will necesitate placing three single-pole main switches instead of one three-pole main switch. The circuit breakers which are to be non-automatic will be placed on an extension panel above the main instrument panel.

Each of the three generator panels is to be furnished with the following instruments: One 3000-ampere, non-automatic, double-pole circuit breaker; three 3000-ampere, single-pole, double-throw, main switches; three 3000-ampere, long scale, alternating-current ammeters; one 400-ampere Westinghouse round pattern, dead-beat, direct-current ammeter for field circuit; one 400-ampere, double-pole, single-throw, quick break, field switch, with shunt resistance and discharge attachment; three series transformers, two shunt transformers, etc., etc.

The multiplying panel, which is to carry the necessary instruments for multiplying the duplicate sets of three-phase bus-bars, will be furnished with the following apparatus: One 3000-ampere, double-pole, non-automatic circuit breaker; three 3000-ampere, single-pole, single-throw multiplying switches; one synchroscope; one three-pole, double-throw switch for throwing the above specified synchroscope onto either one of the three sets of two-phase bus-bars, etc., etc.

For each group of three raising transformers there will be three switchboard panels similar to those at present installed in the generating station. Each of these panels will have mounted upon it the following apparatus: One 1500-ampere, single-pole, 1000-volt, automatic overload circuit breakers, with time limit relays; one 1600-ampere, long scale ammeter; one 1600-ampere, double-pole, double-throw main switch, etc., etc. For each set of three panels which con-

trols a group of transformers there will be needed: One polyphase, integrating wattmeter and two shunt transformers.

All the electrical apparatus is to be furnished by the Westinghouse Electric & Manufacturing Company. The installation and rapid increase of this plant is due to the energy of President Charles H. Baker, of the Snoqualmie Falls Power Company. It is certainly one of the finest and most reliable water power properties in the United States.

The History of a Municipal Enterprise in Toledo, Ohio.

The story of the manner in which at Toledo, Ohio, a municipal plant has once again proved a hollow fraud is given in the following special dispatch of Sept. 6 from that city:

Municipal ownership of a public utility has been tried in Toledo and found wanting. The city natural gas plant, which has cost the municipality about $1,500,000 so far, has just been turned over to the Toledo Gas Light & Coke Company, a corporation which has a monopoly of illuminating gas in this city. The company's bid for the plant, which the Council accepted, proposed a 20-year lease of the property, the city to receive $6,500 per annum in cash as rental; that illuminating gas shall be furnished at 95 cents a thousand cubic feet, and that fuel gas shall be paid for at the rate of 70 cents a thousand cubic feet.

The City Council refused to consider a second bid, which was supposed to come from Standard Oil interests, and which offered $7,000 in cash each year for 20 years for a lease of the plant, illuminating gas at 85 cents and fuel gas at 65 cents a thousand feet. The principal objection to this bid was that it was made by a local lawyer as trustee and that he refused to disclose the names of the persons for whom he was acting. Mayor Jones, who is known to be a stanch advocate of municipal ownership, neither signed nor vetoed the ordinance leasing the plant. The legislation was permitted to become operative under the State law which provides that municipal measures that are neither vetoed nor approved by the Mayor have the effect of law in 10 days after their passage by Council.

The city gas plant has had the stormiest career of any public utility in this part of the country. It was established in 1890, when a group of politicians made the people of Toledo believe that by the judicious expenditure of a million or so in building a municipal natural gas plant the people would not only get fuel gas dirt cheap for themselves, but could sell enough of it to manufacturers and others to pay the cost of the plant and also, in practically no time, pay off the city debt. So the people voted to issue bonds to the amount of $750,000 and went into the natural gas business.

Altogether since May, 1890, the city has issued $1,050,000 natural gas bonds, and has paid, or will have paid by Oct. 1 of this year, $449,500 interest on the bonds. And the interest account will keep up for many years to come.

The legislation which enabled the city to issue the gas bonds was passed only after the bitterest conflicts in the General Assembly and the City Council.

Failing to check the preliminary establishment of the plant, the opponents of the city line bent their energies toward preventing the city from marketing the bonds, and with partial success. The city next had difficulty in securing profitable gas territory. The gas supply which the municipality secured began to fail. Customers who had put up with cold meals in cold weather were loud in their grumbling; and presently it was not considered civic treason to condemn the city gas plant.

Pumps to re-enforce the pressure of gas were installed, and would have worked satisfactorily had there not been a constant dwindling of the supply in the city's gas wells. Within the last three years patrons dropped away from the line to such an extent that it no longer paid expenses; and when 18 months ago, an ordinance was introduced in the Council to invite bids for the property, there was little popular opposition.

One of the recent financial reports made by the trustees showed that there was but $30 in the city gas fund. As fast as the opposition company could put in connecting lines for them, former patrons of the city line went over to the private concern, until the city line's customers could be counted on the fingers of both hands. Now the former stanch supporters of the municipal gas line are willing to admit that it was one of the most disastrous undertakings the city ever assumed.

Independent Telephony in Ohio.

While Ohio is admittedly the stronghold of the independent telephone movement, and the development has reached a higher plane than in any other State, the territory is far from being fully developed. Although over 1200 towns, villages and hamlets are reached by the independent lines, new exchanges are being built as rapidly as ever before, and at the present rate it seems probable that it is only a question of a year or two before every citizen of the State will be accessible by the independent lines. Just at present the movement is especially progressive and within the next two or three months a number of important exchanges, giving service to thousands of new subscribers, will be cut into the main system. It might be added that some of the companies which have commenced business within the past year have made some astonishing gains. Here are a few of the latest developments in the State: Ground has been broken at Dayton for a system which will cover the whole of Montgomery County, the original investment for which will be $750,000. The business section of the city system will be all underground, and work has started on an exchange building which will cost $50,000. A contract has been placed for a Kellogg multiple central energy switchboard of 10,000 capacity. Rates will be $24 for residences and $40 for business. Since June 1, 2200 contracts have been closed. Practically the same condition exists at Toledo where 400 men are at work on the new system. Inside of three months, it is claimed, 5500 subscribers have been secured, and the exchange will probably open with 6000. At present the Bell company is said to have 2695 names in its Toledo directory. About Oct. 1, the following large exchanges will be opened for business: Canton, 1500 subscribers, ultimate capacity of board, 2000; Alliance, 450 subscribers, ultimate capacity, 600, both exchanges having Kellogg boards; Mansfield, 1200 subscribers, ultimate capacity 2000; Zanesville, 1200 subscribers, ultimate capacity 2000, both with American Electric Telephone boards. At Lima a new company has recently bought up the old independent exchange, and is rebuilding it, installing a Sterling board. The exchange will open in the near future with 1200 subscribers in the county, this being one of the best farming sections of the State. It is stated that the opposition has 694 subscribers in that district. At Bowling Green, a town of 5000 inhabitants, the independent company, has made an increase since Dec. 1, from 128 subscribers to 512. Within the next 30 days the Massillon Telephone Company will be consolidated with the Stark County Telephone Company, one of the properties of the Federal Telephone Company. The Massillon company has 800 subscribers against 325 for the opposition, and subexchanges are to be built in the neighboring towns of Canal Fulton, Dalton and Navarre, which are to be included in the deal. The Columbiana County Telephone Company will soon open exchanges at Toronto and New Cumberland. This company has 2500 subscribers against 793 for the opposition, and it has increased the number from 1400 since December.

It is a surprising fact that while Cleveland has the largest independent exchange in Ohio, and, it is claimed, in the country, it is, with the exception of Cincinnati, which is not developed, the only large city in the State in which the opposition has the advantage. A year ago the Cleveland Telephone Company (Bell) had about 12,000 subscribers, while the Cuyahoga Telephone Company had about 6000. General Manager Mark Davis, of the latter company, claims that on Sept. 1 a comparison of the two directories shows that the Bell company has 9500 subscribers and the independent 8500; and he adds that Jan. 1 will see the conditions reversed.

It is stated by the officials of the Federal Telephone Company that it is now only a matter of a year or so before there will be a powerful independent exchange in Cincinnati connecting with the surrounding towns. It is stated that while the Federal Company will not control the new situation, it will lend its support to the work, since an exchange at this point is much needed to increase the efficiency of the long-distance wires throughout the State.

Electricity for the Trunk Roads.

It is stated that a general conference of the operating officers of the railroads operated between New York and Chicago will be held to consider suggestions for operating suburban passenger trains by electricity. Propositions have been submitted by electricians to substitute electrical power for steam with guarantees that heavy trains can be moved with regularity and safety at the rate of 70 miles per hour.

Convention of the International Association of Municipal Electricians.

MR. MORRIS W. MEAD, the president of the International Association of Municipal Electricians called the meeting to order at 2 p. m. on Monday, Sept. 2, at the International Hotel, Niagara Falls, N. Y., nearly 150 members being present. The Rev. A. S. Bacon offered the opening prayer, following which Mayor M. B. Butler delivered the address of welcome. He referred to the great power development, and noted how closely allied to it were the interests of the members of the association. Captain William Brophy, of Boston, responded to the Mayor's address in behalf of the association.

The address of President Mead was then delivered. Its import was that the members were there for business. His remarks, which were of a thoughtful character, contained many excellent suggestions, and were replete with valuable information. He believes in progressive electricity, and desired every member to keep fully abreast of the times.

When President Mead finished his address, which was listened to with close attention, Frank C. Mason, of Brooklyn, stepped to the front and, on behalf of the association, presented to Morris W. Mead, Jr., the latest member of the Mead household, a solitaire diamond ring and a Niagara souvenir spoon. Three cheers were given for Master Mead, and he was made an adopted son of the association.

Various letters and invitations were read, and then W. Y. Ellett, of Elmira, N. Y., was appointed sergeant-at-arms. W. M. Petty, superintendent of telegraph of the Rutherford, N. J., fire department, read a paper on "The Protection of Fire and Police Telegraph Wires from High-Tension Currents and Lightning." He thought the term "lightning arrester" was a misnomer, that the apparatus should more properly be known as a "diverter." He also advised the abandonment, except for testing purposes of the ground wire now found in general use in the fire-alarm boxes. Mr. Petty's paper was warmly discussed by all the members, the debate consuming the entire remainder of the day's session. Before adjournment, President Mead announced that Friday, Sept. 6, had been bulletined as Municipal Electrician Day by the managers of the Pan-American Exposition at Buffalo.

During the session the ladies of the party were entertained by a local committee with a carriage drive through the park, a visit to the Natural Food Conservatory, and other points of interest. In the evening there was a ride down the gorge electric road to the Whirlpool Rapids and return, with electric searchlight effects.

The convention reassembled on Tuesday morning at 9.30. Mr. Guy Owen, a delegate from Honolulu, Sandwich Islands, was introduced. He stated that he would be glad to explain the fire-alarm system in use in Honolulu to any of the members.

Mr. H. W. Pope, general manager of the Bell Telephone Company, of Buffalo, N. Y., was next introduced, and addressed the convention at some length. Mr. Pope, in his preliminary remarks, mentioned the fact that in 1870 he called a convention of American district telegraph superintendents which included the fire alarm people of those days. He then explained the availability of the telephone in fire and police telegraph service, and stated that the company of which he is manager had a record of giving local telephone connection in the average time of three seconds.

In the discussion that followed, Mr. F. C. Mason, of Brooklyn, described his telephone system which he said was a very efficient one, and gave general satisfaction to all of the city departments. Mr. H. W. Pope was voted the thanks of the association for his address, and was elected an honorary member of the organization. It was decided that a certificate of membership should be issued to all members, and the matter was referred to the executive committee. The report of the committee on statistics was next received, and the commitee was ordered to continue its work and to report further at the next convention.

Next in the order of exercises was a paper entitled "Municipal Control vs. Municipal Ownership," which was read by the author, E. F. Schurig, city electrician of Omaha, Neb. Mr. Schurig in summing up his argument expressed himself as not in favor of municipal ownership, but approving municipal control. This paper was freely discussed, together with the paper following, written and read by Captain William Brophy, of Boston, on "Inadvisability of Placing High and Low-Potential Wires Through the Same Series of Conduits, or Through the Same Manholes."

Secretary Frank P. Foster then read a paper entitled "Improved Storage Battery for Municipal Purposes," contributed by J. W. Aydon, of Wilmington, Del.

Mr. H. C. Bundy, of Watertown, N. Y., explained the make-up of his storage battery.

At the afternoon session Secretary Foster read a paper from the pen of Mr. P. H. Trout, Jr., of Lynchburg, Va., on the "Need and Value of a Set of Rules for Outside Construction."

On Wednesday, Sept. 5, the meeting was called to order at 8.30 a. m. by President Mead, who introduced P. H. Alexander, of New York. Mr. Alexander read an interesting paper on "Magneto Electric Car Brakes." This received the close attention of all present, and a vote of thanks was given to the author for his contribution.

Dr. L. E. Niles, president of the Magneto Electric Company, of New York, was introduced and asked to explain his magneto system for fire and police telegraph. This system was described and illustrated in ELECTRICAL WORLD AND ENGINEER, Dec. 1, 1900. A committee of five was appointed to examine and report upon the magneto system at the next meeting of the association. This committee consists of F. C. Mason, R. E. Moran, of Memphis, Tenn.; Captain William Brophy, of Boston, Mass.; E. F. Schurig, of Omaha, Neb., and J. Murphy, of Cleveland, Ohio.

Richmond, Va., was selected as the next place of meeting, the date thereof to be named by the executive committee. The following officers were then chosen for the ensuing year:

A. S. Hatch, president, of Detroit, Mich.
W. M. Petty, first vice-president, of Rutherford, N. J.
A. G. Farrand, second vice-president, of Atlantic City, N. J.
William Crane, third vice-president, of Erie, Pa.
William A. Barnes, fourth vice-president, of Bridgeport, Conn.
F. P. Foster, secretary, of Corning, N. Y.
Adam Bosch, treasurer, of Newark, N. J.

Captain Brophy, in a few well chosen remarks, eulogized the efficient work performed by Frank C. Mason, of Brooklyn, in organizing the association. By a unanimous vote of those present Mr. Mason was elected a life member of the association, a well-deserved compliment for faithful service.

Origin of "Mother of Pearl" Clouds.

The daylight effect of the aurora borealis would appear to be that of "mother-of-pearl" clouds. The last Danish expedition which was sent to the Polar regions to study the aurora borealis observed these so-called "mother-of-pearl clouds," which are described in the reports of the Danish Academy of Sciences. These clouds resemble the so-called "shining clouds," and were given their name by the Norwegian meteorologist, Professor Mohn. The Danish scientists twice had an opportunity of seeing such celestial phenomena. Once they succeeded in measuring the distance of these clouds above the earth, which was found to be about 40 kilometers. The second time measuring was not possible because all the members of the expedition were in one place, but they were able to make some observations about the movement of the cloud. At first it looked like a horizontal band in the southwestern horizon at a height of 30 or 35 degs. Then it moved slowly toward the east, stopped, and finally returned to its original position. During its retrograde motion a part of the cloud was torn off, the fragment assuming a circular shape, and floating alone with a rapidity of 1 deg. in 4 seconds toward the south. Having passed through 7 degs. of the firmament, this small cloud was dissolved.

It is evident that these motions are peculiar to the "mother-of-pearl clouds," because another cloud which was in the same tract of sky at the same time remained motionless. The color of these formations at the edge was mostly red, but toward the middle it changed from rose color to green. The clouds were visible in broad daylight about noon. An observation through the spectroscope gave only the lines of the common spectrum of the sky at daylight, together with some absorption lines, which indicate a great quantity of vapor. It was perhaps the strong sunlight which prevented the observation of any peculiarities in the spectrum of these clouds.

Their motion cannot be caused by any wind. Professor Poulsen, the head of the expedition, is rather of the opinion that the "mother-of-pearl clouds" are moved by other forces, partly, perhaps, by electricity. Poulsen explains the formation of such a cloud by currents of negative electricity, by virtue of which the atmospheric vapor is condensed. The clouds probably move in the direction of the electric currents.

The Pittsburg Exposition.

The thirteenth annual exposition was opened in Pittsburg on the evening of Sept. 4, and it is the general verdict that this year's show is a worthy successor to its predecessors.

The exposition was organized for the purpose of giving every year an exhibition of the goods made by local manufacturers. Among the exhibitors are locomotive builders, steam engine makers, gas engine manufacturers, etc. In the electrical field the Westinghouse Company, of course, takes the lead. It has a number of its generators, motors and switchboard appliances in its space. An exhibit is also made of the Nernst lamp, which is attracting a great deal of attention, because it is the first time the local public has had an opportunity of seeing this new lamp.

The exposition building is brilliantly illuminated by several thousand incandescent and arc lamps, furnished by the Allegheny County Light Company and the Westinghouse Company. It will close Oct. 31.

The New York-Buffalo Automobile Test.

A most interesting start was made on Monday morning at 8 o'clock of the New York-Buffalo endurance test of the Automobile Club of America, for which at the close of the prescribed time there were no fewer than 85 entries, not one of which, however, was electric. The distance to be traversed this week is about 465 miles, including some of the worst roads in creation running through the oldest and most civilized and densely populated portions of New York State. In fact, part of the route had to be changed before starting on account of a "washout" near Albany. The rules of the contest were published in full in the ELECTRICAL WORLD AND ENGINEER of Aug. 3, all based on the idea of maintaining an average speed rather than making a high rate at any time, the limits being 8 and 15 miles per hour. The vehicles are divided in three classes: A, under 1000 lbs.; B, 1000 to 2000 lbs.; C, 2000 lbs. and over; D, motor cycle class, and E a special class for public delivery wagons. In addition to the three classes of certificates to be awarded there will be three cups, one for each class, A, B and C, from Messrs. Shattuck, Whipple & Scarritt, for a hill-climbing contest at Nelson Hill on the first day.

Among the starters on Monday morning were Messrs. A. L. Riker and wife, in a handsome 16-hp Electric Vehicle Company's Riker gasoline touring car; H. Ward Leonard in his 5-hp gasoline, and C. J. Field in a De Dion-Bouton gasoline motorette. There were several gasoline Electric Vehicle automobiles in the line. Of the 80 vehicles listed in the printed schedule issued before starting no fewer than 53 were gasoline. Several of the vehicles were of foreign make, chiefly, if not wholly, French, and many of them Panhard-Levassor, one of which was occupied by President Shattuck.

CURRENT NEWS AND NOTES.

A MAGNETIC OBSERVATORY is to be built by the United States Government at Sitka, Alaska. Dr. H. W. M. Edmonds, of the Coast Survey, is in charge of the work.

THE CZAR IN FRANCE.—During his visit to France the Czar of Russia is to visit the famous chateau of Compiegne, so closely associated with the Napoleonic regime. The most difficult problem in connection with making the chateau ready for the Czar has been fitting it with electric light. The difficulty has been overcome by passing a cable up to the roof and thence distributing wires through the windows. The chateau will be provided with 1600 lamps of 16 candle-power for the apartments and 600 for the theater. Motive power is provided by four 75-hp engines placed in the confines of the park. The power house and cable connections will be carefully guarded by troops.

REFLECTING INCANDESCENT LAMP.—A patent granted Sept. 3 to P. A. Gibbins describes an incandescent lamp in which the filament is in proximity to a prismatic reflector. Several forms of reflectors are shown, one being in the form of a cylinder with a star prismatic section, another in the form of a corrugated ellipsoid—in both of these cases the filament being arranged spirally about the reflector. Two other forms are shown for use when the light is to be cast downward, in this case the prismatic reflector having a corrugated spherical surface. The interior of the reflector is coated with any suitable substance to make a reflecting surface. It is claimed that there is an advantage from having the exterior surface in the shape of a series of prisims.

WATTMETER BRAKE.—The usual method of braking employed in electric meters is based upon the application of a Foucault disk rigid with the indicating device. A disadvantage of this method is that it renders the moving parts very heavy, whereby the sensitiveness of the apparatus is greatly diminished, the pivots wear quickly and a special arrangement is necessary to prevent breakage of the pivot stone when transporting the apparatus. In a patent granted Sept. 3 to Felipe Saldana, the ordinary movable solid disk is replaced by a ring which moves through a highly concentrated magnetic field having only the width of the ring. By this means the weight of the moving part is stated to be very greatly reduced.

PROTECTING THE CHILDREN.—President Jacob L. Greatsinger, of the Brooklyn Rapid Transit Company, has had an interview with Deputy Police Commissioner York, in which he suggested that the police aid in preventing trolley accidents in the future. President Greatsinger believes that the danger may, to some extent, be obviated if very young children are not permitted to play in the streets where the cars run. It was pointed out to Mr. York that of the deaths reported from trolley accidents during the last eight months 17 of those killed were little children. The plan of segregating the children in the quiet streets is not regarded as feasible by the Deputy Commissioner. He, however, promised to do all in his power to assist the railroad officials. Instructions have been sent to the police of every precinct in the Borough directing them to look carefully after the children. If any are found playing in the middle of the street along trolley routes they are to be turned back to the sidewalk.

BRITISH PACIFIC CABLE.—An interesting report, showing the progress of the work on the British Transpacific cable—to be the longest cable ever laid—has been received at the State Department from Consular Agent Robinson, at Norfolk Island. The report states that on the passage across to Norfolk Island from Brisbane, Australia, soundings were taken every 10 miles by the British cable steamer "Britannia," which is being used to mark out a track for the cable. About 100 miles from the coast an obstruction was met with in the shape of a range of submarine mountains lying directly in the track, and a deviation to the south had to be made to clear it. The greatest depth obtained was 2800 fathoms, and the most shallow 237 fathoms, the latter being the depth recorded when the ship was right above the tops of the mountains. It has been decided to land the cable at Anson Bay, on the west side of Norfolk Island, and a cable house is to be built there. Norfolk Island will be one of the most important stations of this cable route, as all messages to Australia and New Zealand will converge there to be repeated.

ILLUMINATION FROM ARC LAMPS.—In the discussion at the recent convention of the Ohio Electric Light Association it was stated that alternating-current enclosed arc lamps had been found to make mahogany furniture appear to be covered with a bluish-white fine dust, and a remedy was asked. One of the audience said that a reduction in the size of the carbon, or an increase in the current, or both, would be beneficial, though a careful selection of globes would do much in the right direction. Globes of a greater opalescence filter more of the violet light and have a tendency to make a more perfect balance of the spectrum, thus approaching the daylight effect. Another member advised the use of a 7 or 7½-ampere lamp, and said that he had observed that the quality of the light from an alternating-current enclosed arc lamp is materially improved by raising the voltage. It is not only the increase in the quantity of light that causes the improvement, which is also due to the increase of current at the arc, whereby the carbons are heated to a high degree and become to a certain extent luminous members, and assist the steadiness of the illumination at the moment the arc changes its polarity. Shortening of the arc will also help to overcome the difficulty mentioned, but an increase in current will remedy the defect to a greater extent.

THE ELECTRICAL EXHIBITORS' CLUB at the Pan-American has elected as honorary members Messrs. Moore, assistant chief of the machinery section, etc.; L. Stieringer, consulting electrical engineer; H. Rustin, chief of mechanical and electrical construction, and Professor G. F. Sever, superintendent of electrical exhibits.

TRANSPORTATION DAY will be celebrated Sept. 14, all being well, at the Pan-American Exposition, and should draw crowds. Senator Depew, formerly president of the New York Central Railroad, is to make the oration in the Temple of Music. A pageant is proposed illustrative of the evolution of the arts of transportation.

PIKE'S PEAK ELECTRIC ROAD.—A newspaper dispatch reports that Colorado Springs capitalists have organized a company to build an electric railway to the top of Pike's Peak, an altitude of 14,143 ft. The road will cost $500,000 or more. It will start from Colorado Springs, or from some station on the Cripple Creek Short Line. Work will begin immediately.

DRAWBAUGH IN WIRELESS TELEPHONY.—It is stated that Mr. Daniel Drawbaugh, of telephone invention fame, has developed a system of wireless telephony and telegraphy. He uses the "strong electric currents in the earth" as the medium of communication. The newspaper containing this information refers to Mr. Dawbaugh as "the aged farmer of Eberly's Mills."

A PROTECTIVE PHONOGRAPH.—Dr. S. H. Albeneius, of Central Avenue, Jersey City, has recently put in operation a large concert phonograph in opposition to the Salvation Army meetings, which are held nightly at Central Avenue and Charles Street. The phonograph, it is said, has completely routed the singers, who have been making life a burden by their intolerable noise.

COLORADO SOUTHERN TO USE ELECTRICITY.—President Frank Trumbull, of the Colorado & Southern Railroad, who is now in New York, says that the directors of his company are considering a plan to use electric motors on the suburban service in Denver territory. This change is regarded as practically certain, and believed to insure a marked saving in operating expenses.

SUPERSEDING STEAM LOCOMOTIVES.—It is stated that President James J. Hill, of the Great Northern Railroad, has ordered that steam locomotives be superseded by electric motors on the Cascade division of the Great Northern. If this change works out satisfactorily the electric motors will be introduced into other divisions of the Great Northern system. The gases in the Cascade tunnel have already overcome several of the engineers.

READING METERS.—At the recent meeting of the Ohio Electric Light Association Mr. Alexander Dow remarked that the best practice now is not to use dial blanks for indicating positions of the hands, but to allow the inspector to put down the figures as he reads them. Electric light companies have in this respect profited by the experience of the gas companies, the practice of which is now to record the reading in figures without showing the dial position.

TELEGRAPH LINES TO STRAITS OF BELLE ISLE.—The Dominion Government telegraphs have been extended to Chateau Bay in the Straits of Belle Isle, and stations have been established at Pointe du Maurier, Harington, Mutton Bay, St. Augustin, Bonne Esperance, Blanc Sablon, Red Bay, and Chauteau Bay. From the latter place a cable will be laid to Belle Isle, and a signal station established. It is the intention of the Government to test the Marconi wireless system between the same points. The completion of this work will be of assistance to the shipping using the Straits route.

METER REPAIRS.—In a discussion on the subject of wattmeters at the recent meeting of the Ohio Electric Light Association, one of the speakers said that whenever a jewel is changed in a meter the pivot should also be changed, as in 90 per cent of the cases the pivot will be found defective as well as the jewel. Referring to a statement that in one plant 261 jewels had been renewed. and but 33 pivots, the prediction was made that the meters would on the next test show a still more alarming condition than in the first instance, owing to the retention of pivots that were probably inferior and defective.

ARC LAMP FOR LUPUS CURE.—A dispatch from Copenhagen, Denmark, says that Dr. Sophus Bang, manager of the laboratory belonging to Professor Finsen, inventor of the light cure for lupus, has constructed a special electric lamp, giving a feeble light, but which is extremely rich in chemical rays. The dispatch adds that Dr. Bang used metal instead of carbon "points." The bacteria-killing power of this lamp is 10 times as great as that of an ordinary arc lamp, and a lupus patient requiring 75 minutes' treatment with the arc lamp will require only from three to five minutes' treatment with the new one.

END OF PIGEON POST.—A special dispatch from London of Sept. 7 says: Lord Roberts has once more openly shown his contempt of some of the methods of Lord Wolseley, his predecessor in the office of Commander-in-Chief. He has ordered the discontinuance of the experimental pigeon post service for war purposes at Aldershot, which was instituted by Wolseley. The pigeon loft is now being removed and the birds disposed of. Several hundred young birds had been already trained up to 20 miles, and the officer in charge stated as his opinion that the experiment had more than justified itself. About $6,000 has been spent on the scheme.

WOES OF THE ENGLISH TELEGRAPH GIRL.—A cable dispatch from London of August 31 says: The Central Telegraph office has been a scene of embittered strife between the controller and 2000 women telegraphers. The controller, who is a man of severe mind, trained in the north, ordered the closing, during working hours, of the dressing rooms where looking glasses are kept. The girls petitioned against this, and protested against his tyranny. The controller replied by accusing them of squandering the time of the Government. Despite angry appeals over the controller's head, he still refuses to unlock the door, and the girls have to take messages for eight hours without having a look at themselves in the glasses.

RUBBER IN FRENCH AFRICA.—A consular report says that explorations in connection with the production of rubber began in Madagascar in 1851, and have of late years increased to a notable extent. M. Jamelle recently called attention to the "piralahy," a new shrub of the genus *Landolphia*, which is found in the forests of Bueni, in Majunga, in Andriba, and in the valley of Betisbooka. In the French Kongo, also, a few apocyneous plants of the genus *Landolphia* are met with, which yield a quantity of india rubber. The amount produced is estimated at 500 tons per annum. The whole country, says M. Savorgnan, is literally covered with rubber trees. The yield in Senegal is small at present. The aborigines are just beginning to bring into the market a clear substance called kurussa, whose commercial value approximates that of the rubber of Para.

CANADIAN LONG-DISTANCE TRANSMISSION PLANTS.—In view of the increasing number of transmission enterprises in Canada, the following data on such plants now in operation and in course of development will be of interest: Chambly Manufacturing Company, Chambly, Que., 20,000 horse-power, 17 miles to Montreal, 25,000 volts; Hamilton Electric Light & Cataract Power Company, De Cew's Falls, Ont., 10,000 horse-power, 33 miles to Hamilton, 22,500 volts; West Kootenay Electric Power Company, West Kootenay, British Columbia, 4000 horse-power, 30 miles, 20,000 volts; Dominion Government, Soulanges Canal, Que., 700 horse-power, 14 miles, 2400 volts; Light, Heat & Power Company, Lindsay, Ont., 535 horse-power, 17 miles, 11,000 volts; Trenton Electric Company, Trenton, Ont., 735 horse-power, 12 miles, 11,000 volts; British Columbia Electric Company, Victoria-Goldstream, B. C., 1000 horse-power, 12½ miles, 10,000 volts; Shawinigan Water & Power Company, Shawinigan Falls, Que., 10,000 horse-power, 80 miles to Montreal, 33,000 volts (projected transmission); Canadian Niagara Falls Power Company, Niagara Falls, Ont., 15,000 horse-power, 90 miles to Toronto, 44,000 to 66,000 volts (projected transmission); Lachine Rapids Hydraulic & Land Company, Lachine Rapids, Que., 12,000 horse-power, 6 miles to Montreal, 4400 volts; Canadian Electric Light Company, Chaudiere Falls, Que., 2000 horse-power, 9 miles to Quebec, 6000 volts; St. Lawrence Power Company, Mille Roches, Que., 4000 horse-power, 6 miles to Cornwall, Ont., and 73 miles to Montreal, 11,000 volts on Cornwall line.

HORSE CARS have now entirely disappeared from Massachusetts, except in museums, where they are placed alongside Indian arrow heads and flintlock muskets.

LIGHTS AND LIFTS FOR THE KING.—A very large sum is being spent in getting Buckingham Palace in readiness for the reception of the royal guests at the coronation of King Edward. Hitherto it has been lit by gas, but electric light is now being installed, the antiquated and faded furniture is being replaced by suits of more modern pattern, and the principal apartments are being newly decorated and fitted with luxurious, up-to-date appointments. As already noted in these columns, one of the innovations is a fine equipment of American electric elevators.

AN AUTOMOBILE SAVINGS BANK.—The authorities of Mezieres, France, wishing to encourage thrift, have had built to specifications, an electric motor car bank containing four seats, one for the driver and three in the rear arranged around a small table. Folding shelves make a desk for a person standing beside the vehicle. Under the table is a small safe. The passengers are two clerks from the local treasury department and a cashier. The car travels about the country making short stops in the villages on prearranged days, and receiving such sums as the citizens or farmers of the neighborhood may wish to deposit. Riches have been known to take wings, but this is the first time they took an automobile.

EXTRACTION OF PRECIOUS METALS BY ELECTROLYSIS.—An electrolytic amalgamator recently patented by Charles P. Tatro and George Delius, of Seattle, Wash., comprises a covered cylindrical tub in the bottom of which is a copper pan containing a body of mercury serving as the cathode to collect the precipitated metal. The anodes, of carbon, are suspended from the cover, while a bladed propeller, likewise hung from the cover, revolves beneath them and above the cathode, keeping the ore in suspension in the electrolyte. The device is thus a modification of the well-known Pelatan-Clerici cell, possessing the advantage that the attachment of the revolving blades to the cover permits the latter, and with it the anodes, to be lowered readily into a heavy pulp. An additional and novel feature is the provision of a small supplemental anode in the side of the tank, electrically connected to insure that a light current shall at all times flow to the surface of the mercury and thus prevent flouring or sickening when the main circuit is broken.

RAILWAY DEALS IN OHIO.—An important step was taken on Aug. 29 in the amalgamation of the Everett-Moore properties into the Lake Shore Electric Railway, when the directors of the Lorain & Cleveland, the Sandusky & Interurban, the Sandusky, Norwalk & Southern and the Toledo, Fremont & Norwalk companies met at Cleveland, Ohio, and unanimously voted to consolidate. Formal notices to the stockholders to meet Sept. 19, to vote on the proposition, were authorized and temporary officers of the consolidated company were elected as follows: President, Barney Mahler; vice-presidents, J. B. Hanna, W. H. Price; secretary, F. W. Coen; treasurer, C. H. Stewart. Directors: B. Mahler, J. B. Hanna, H. A. Everett, E. W. Moore, C. H. Stewart, J. B. Hoge, W. H. Gawne, H. W. Price and J. H. Harding. The consolidation will give a total mileage of about 159 miles. The Lorain & Cleveland has 22 miles, the Sandusky & Interurban, 53 miles; the Toledo, Fremont & Norwalk 52 miles, and the Sandusky, Norwalk & Southern 32 miles. The new company will be known as the Lake Shore Electric Railway Company. Reference to this new deal was made in these columns Aug. 31 last.

AN INDUCTION FURNACE.—An electric furnace in which conductive charges may be melted by currents of electricity induced within them has been patented (Sept. 3) in this country by the Swedish engineer, Fredrik Adolf Kjellin. The construction is extremely simple, the charge, which must be a conductor of electricity, being so packed within an annular groove in a body of refractory material as to form a closed circuit which constitutes the secondary of a step-down transformer, whose primary, a cored coil of insulated wire, is placed within the annulus, and connected to a source of alternating currents. In operation the current induced in the charge is found sufficient for such metallurgical operations as admit of a closed metallic circuit within the annular furnace chamber. The furnace would seem to be especially adapted for the melting of platinum and other metals which, particularly at high temperatures, possess such power of occluding hydrogen and other gases as to render it extremely difficult to obtain perfect castings by the use of the oxyhydrogen flame, or similar combustion methods. A furnace of the same general type has been heretofore patented in this country and abroad by Edward A. Colby, and in England by De Ferranti. Kjellin's construction differs from these in that compactness and an increased efficiency are gained by placing the primary within the secondary, and thus, for a furnace of given size, very materially reducing the space between these elements.

MAGNETIC SPEED INDICATOR.—Magnetic speed indicators have been devised depending upon the pull which moving permanent magnets exert on a copper disk, but one objection to this type has been that owing to the energizing magnets being movable, a speed indicator has to be made very large in order to produce an appreciable effect. Mr. Simon P. Storer in a patent dated Aug. 20 describes a magnetic speed indicator in which the magnet is stationary and having concentric annular poles adapted to give the most powerful effects. Within the field of this permanent magnet is mounted a soft iron keep or armature which is movable, being in the form of a cylinder moving in the space between the poles. The armature is furthermore toothed so as to cause a bunching or tufting of the lines of force in the magnetic field within which it moves. Concentric with the cylindrical armature is a copper cylinder which can be made the movable part, or the soft iron armature may be made movable. In either case, one part or the other when in motion exerts a pull which is in proportion to the speed of revolution, the pull being counteracted by a spring connected with the part upon which it is exerted. The latter part thus will be displaced from its normal position by an amount which is proportionate to the speed of the moving part. A copper shield may be placed in a fixed position close to the soft iron armature so as to act as a damper against any sudden acceleration of the armature, the instrument thus becoming dead-beat.

A NEW ARC LAMP.—A patent granted Sept. 3 to Daniel Higham relates to a direct-current, constant-potential arc lamp, and provides for a regulating series magnet having one portion of the winding fine and of high resistance, the other portion coarse and of low resistance, and a coil of high self-induction of low resistance in parallel with the fine wire portion of the magnet. The result of this arrangement is that the current entering the lamp divides between the inductance coil and the fine-wire winding, about 10 per cent of the current flowing normally through the latter. Upon an increase of the voltage in the mains or of a current in the arc, the inductance coil resists the increase of current in it and compels it to flow through the fine-wire winding. This effect is only momentary, however, since the inductance coil quickly adjusts itself to the new voltage, but results in strengthening the magnetism of the fine-wire coil, thereby lifting the carbon and lengthening the arc, which takes place before the arc can be seriously affected by the change in the current intensity. A dash-pot prevents the carbon from too violent or excessive movements, or from getting into a condition of rhythmic oscillation. Conversely, upon a decrease of current the magnetism of the fine winding is suddenly lessened and the carbon is dropped. One practical advantage claimed for a lamp thus constructed is that it automatically adjusts itself to any voltage, so that the same lamp can be connected to any circuits carrying, for example, anywhere from 90 to 120 volts without requiring any adjustment or change of parts. Another advantage from this consequent use of a long arc is the greater percentage of watts at the arc and therefore a higher efficiency, while the wide separation of the carbons largely prevents the shadow of the lower carbon from becoming objectionable.

LETTER TO THE EDITORS.

Elevating Presidents and Kings.

To the Editors of Electrical World and Engineer:

Sirs.—On page 38 of your issue of Sept. 7 you have a little squib entitled, "To elevate the King." One would imagine from reading this notice that there was something new about the automatic house elevator. Five years ago the Sprague Company contracted to install an electric one in the White House in lieu of the hydraulic one in

use there. It was installed by Mr. B. N. Jones, electrical engineer, then in the employ of the company. It has been used by the President, Mrs. McKinley, the visitors, the servants and whoever saw fit to utilize it. It performs every function described in your notice, and it is my conviction that were some one to compare it with the one you describe he would find them to be one and the same thing.

It would gratify me very much to see in your columns next week a little note indicating that the President, as well as the King, can be elevated automatically and electrically, and that the precedent was established by an American engineer. And if anybody asks you who that man was, you can say it was Frank J. Sprague. His work in developing the great trolley system of to-day is not the only thing of his that now enjoys world-wide repute and usefulness.

NEW YORK CITY. D. B. CLINTON.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS. MOTORS AND TRANSFORMERS

Artificial Loading of Alternating-Current Apparatus.—GOLDSCHMIDT.—An illustrated description of a method which often simplifies the heat test of large alternating-current apparatus. The machine which is tested is run unloaded at full voltage and the copper wires are heated by a current of normal intensity, but sent into the winding from an external source, especially from a direct-current machine. This requires, of course, that the direct-current machine supplies current to the winding of the alternating-current apparatus, without getting current from the latter. This can easily be done, for instance, with armature winding of three-phase generators connected in ring, as shown in the adjoining diagram. The winding is

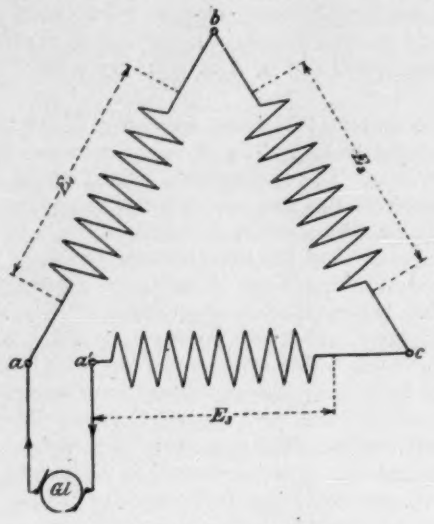


DIAGRAM OF ARMATURE WINDING.

cut at a point *a a'*, and a direct-current machine *Gl* is connected to *a* and *a'*. The geometrical sum of the three voltages E_1, E_2 E_3 is zero. It is true that the sum of the third harmonics does not disappear, so that at open circuit there is a considerable tension between *a* and *a'*. At closed circuit, however, the currents due to this tension are practically zero, because the reactances of the three-phases, connected in series, represent a very great reactance for the triple frequency. The direct-current dynamo is therefore to be connected before the three-phase machine is excited. The direct current in the three-phase armature does not produce a reaction upon the field magnets. Only local magnetic fluxes can occur. They do not cause large eddy currents in the pole shoes. As there is no armature reaction, one works, of course, with too small an exciting current and certain deformations of the field do not occur. The exciting current in our case is practically not different from that for non-induction full load. When the armature wires of the three-phase generator are heated, their resistance increases, so that to get the normal current, the direct-current voltage must continually increase. This increase of voltage, therefore, measures directly the increase of temperature of the armature winding. He then discusses how to apply this method to three-phase alternators with star connection, and to tests of transformers. It is not possible to apply this method to tests of three-phase induction motors.—*Elek. Zeit.*, Aug. 22.

Large Direct-Current Generators.—H. M. HOBART.—An article referring to the paper of Rothert, abstracted in the Digest, March 23, and discussing several general points of the design of large direct-current generators. He discusses in detail the design of a 1000-kw, 500-volt tramway generator. He remarks that the requirements in the United States differ from those in Europe. In the United States it is generally required that an overload of 50 per cent for two hours does not cause detrimental sparking or heating, that for continuous operation at normal load the increase of the temperature over that of the room, measured by a thermometer, is not more than 35 degs. C., that a momentary overload of 100 per cent does not cause detrimental sparking or heating. The corresponding requirements, usually made in Europe, are that an overload of 25 per cent during half an hour does not cause detrimental sparking or heating, that for continuous operation at normal load, the increase of temperature over that of the room, measured by the thermometer, is not more than 50 degs. C., and that a momentary overload of 50 per cent does not cause detrimental sparking or heating. He is of the opinion that the design of a direct-current machine should be based upon the conditions of good commutation. He thinks that Rothert's choice of the same number of poles for 500, 250 and 125-volt machines is not good. For the same power these three machines should be designed differently. For a 500-volt, 1000-kw machine, running at 90 revolutions, he would choose 16 poles, for a 250 machine of the same power and speed, 20 poles. He discusses several general points of the design, and, among other things, he remarks that one should not hesitate to use a high number of revolutions, if this gives a sufficient advantage. He discusses in detail the merits of three different designs of a 1000-kw, 500-volt machine. One design is due to Siemens & Halske, of Vienna, the second to the General Electric Company, of this country, and the third to the author. The latter design he considers a modification and improvement of that of the Gen. Elec. Co. All the details of construction of the three machines are given in comparative tables, and the merits of the three designs are discussed.—*Elek. Zeit.*, Aug. 15.

REFERENCES.

Construction of Alternators.—LASCHE.—A continuation of his well illustrated serial on the construction and systematic manufacture of alternators. He describes the stiffened cast-iron casing, and the stiffening of the armature ring by ties.—*Eng'ing*, Aug. 23.

Slotted Armature.—ROTHERT.—An illustrated translation of his German article on modern windings for direct-current slotted armatures, recently noticed in the Digest.—Lond. *Elec. Eng.*, Aug. 23.

Automobile Motors.—GASNIER.—An illustrated description of quite a number of motors, made by Postel-Vinay for use on automobiles. The construction of the motors is described and illustrated and characteristic curves of the behavior of the motor are given.—*L'Ind. Elec.*, Aug. 10.

POWER

Choice of an Electric Power Distribution System in Factories.—MOSES.—A discussion of the relative merits of the direct-current and polyphase alternating-current systems and of the best choice of voltage for power distribution in factories. The alternating current two or three-phase system at 500 to 220 volts is slightly simpler and more durable and more free from breakdowns than the direct-current system, on account of the simple construction of the induction motor and the absence of a commutator. But in all other regards the direct-current system is said to be preferable. The alternating-current system is not yet fully standardized. It is not applicable yet to charging storage batteries, to railroad work, or to hoisting. The starting currents under load are large, causing more or less fluctuation in lights, and the first cost of dynamos and motors is between 25 per

cent and 35 per cent higher than that of direct-current apparatus of the same capacity. Therefore, unless these disadvantages are balanced by the possibility of commutator troubles, the direct-current system is at present preferable and advisable for ordinary cases of factory transmission. Regarding the best pressure, he says that the advantages of a high transmitting pressure, such as 440 to 500 volts, are low first cost and small bulk of wiring, switches and controlling apparatus. The disadvantages are increased liability to ground, danger of shock, increased number and decreased size of field armature wires and of commutator bars. For small motors, 5 to 50 horsepower, for transmission over short distances, such as 200 to 400 ft., and for fluctuating work, such as elevators, presses, cranes, punches, etc., the 125-volt two-wire system seems preferable. For large motors, transmission over comparatively long distances, or for steady work, where mechanical strength is not essential and where the motor will receive attention, as in silk mills, carpet works, etc., or for work where minimum weight and size are important, the 240-volt system, or one of higher pressure, is usually the best fitted for the purpose. The lighting also has an important bearing on the choice of pressure. He recommends to use 110 to 125 volts for lighting, no matter what pressure is used on the motors. Where the motors operate at 220 to 240 volts, a three-wire system may be used, either with two 120-volt dynamos in series, or a 240-volt dynamo with a small motor-dynamo as balancer, or a 240-volt Dobrowolski dynamo with three brushes. The latter method has recently been adopted for the first time in the United States in the South Station of Boston, and he thinks it will be largely used in future (regarding the Dobrowolski dynamo with three brushes, see for instance, the papers of Sengel, Digest, Sept. 3, 1898, and June 23, 1900). His general conclusion is "that at present prices the 125-volt direct-current two-wire system is the preferable one in most instances, and little or no trouble with the motors or dynamos is experienced at this voltage. Where the distance through which the power is to be transmitted is such as to make the cost of wires for carrying the current too great, the 240-volt direct-current three-wire system should be used. Where there are special features, or where the power is transmitted a distance too great for the 240-volt direct-current system, the three-phase alternating-current system, 60 to 70 cycles per minute, becomes necessary and gives thoroughly satisfactory results. The greatest drawback to the alternating current system to-day is its excessive cost which brings no equivalent advantage."—*Eng. Mag.*, Sept.

Printing Machine.—An illustrated article on "Spence's electric motors for the Hoe four-roll printing machine." At the Glasgow exhibition it prints and folds a daily journal at the following speed: 4, 6 or 8-page papers at 48,000 per hour, 20, 24, 28 or 32-page papers at 12,000 per hour. The mechanical construction of the machine is described. The machine is fitted with a complete electric motor driving equipment. There is a 50-hp, 500-volt compound-wound motor, running at 400 r. p. m. For preparation of the printing rolls and for leading in the paper, a speed of only 16 revolutions is required. This is accomplished by means of a motor-generator, which reduces the voltage. Most of the switching is done automatically.—Lond. *Eng'ing*, Aug. 23.

Electric Power in Factory.—An illustrated description of the electric installation of a billiard table factory in Chicago. There is a steam-driven 150-kw, direct-current generator delivering current at 220 volts. The factory is wired on the two-wire, 220-volt system, the lights and motors both taking 220 volts. There are 11,500 incandescent lamps of 16 candle-power, and six enclosed, constant-potential arc lights. There are 11 multipolar, 220-volt motors in the different departments. They are supported on overhead platforms, and are belted to line shafting for operating the wood-working machinery.—*West. Elec.*, Aug. 31.

REFERENCE.

Electric Percussion Rock Drills.—An illustrated description of the Durkee, Gardner and Hercules drills.—*Eng. News*, Aug. 29.

TRACTION.

High-Speed Electric Traction on Trunk Railroads.—SCHIEMANN.—A paper giving a review of the attempts which have been made in recent years to introduce electric operation on the existing trunk railroads. It is evident that on account of the long distances transmission by polyphase currents is necessary. The following four systems are briefly discussed: First, the polyphase currents are tranformed in converter sub-stations into direct current, which is supplied to the cars; second, the high-tension polyphase currents are transformed in transformer stations along the line into low-tension polyphase currents, the cars being supplied with induction motors; third, the high-tension polyphase currents are directly supplied to the cars, are transformed to low tension in transformers, placed on the cars, and then supplied to the low-tension induction motors, this system being used on a trial line of Siemens & Halske in Lichterfelde (see Digest, last week); fourth, the high-tension polyphase currents are directly supplied to high-tension induction motors on the cars, so that there is no transformation at all. Experiments with this system have been made by Ganz & Co. on a line near Budapest, three-phase current at 3000 volts being used. These experiments have been so successful that this system is to be used on an Italian road of 120 miles in length. Advantages, hoped for from electric operation, are higher speed, greater safety at high speed, and greater simplicity of the signals. If on the present trunk railroads the electric system is introduced, while the old schedule of the trains and in general the old methods of operation are continued, no great advantages would probably follow from electric traction. Such advantages would be obtained only by a change in the method of operation—more trains, shorter trains, higher speed.—*Elek. Zeit.*, July 25.

Large Generating Station Suggested for London Tramways.—G. WESTINGHOUSE.—A communication in which he suggests the formation of a "mutual supply and equipment company," which should supply current to the different tramway companies. The current should be generated in the large power house of the supply company. This would reduce to a minimum the required amount of apparatus and the inconvenience resulting to the public from the installation of such great undertakings. He recommends to use trains of three carriages, two being fitted with motors and controllers, the third being interposed, "unit control" being used. He strongly speaks in favor of large gas engines, supplied by producer gas, in the power house.—Lond. *Times*, Aug. 19; reprinted in Lond. *Elec.*, Aug. 23.

Automobile.—A long illustrated description of the "Electricia" automobile, built by Contal. The motor is enclosed, of light weight and good efficiency. The exciting field current can be varied in wide limits and there are two armature windings connected to two commutators. The combination of variation of the field strength with series parallel control of the two armature windings enables one to vary the speed at will, without changing the connection of the battery cells. The battery is of the Faure type. The grid is formed of two beveled plates, which are mechanically filled with the active material. The composition of the active material is kept secret, but is claimed to be entirely different from those generally used. The following results of tests made by the Central Laboratory of Electricity with a 21 plate cell, are given: Total weight, 28.8 lbs.; capacity, 434 or 384 of 290 watt-hours when discharged with 14 or 33 or 49 amperes, respectively.—*L'Ind. Elec.*, June 25.

REFERENCES.

High-Speed Electric Railway.—A note stating that the contemplated express service between Berlin and Hamburg continues to attract much attention. It will have to be carried above or below all existing railways, streets, etc. Three sets of rails are proposed, so that there are always two lines available, while the third is being repaired. Some notes are given on the calculated costs and the proposed schedule. During the hours of main traffic trains will go every 10 minutes.—Lond. *Eng'ing*, Aug. 23.

Recent Practice in Electric Railway Construction and Operation.—A long article on modern track construction, and on dangers of accidents on suburban lines, on grade crossings, and on single-track lines when cars running in opposite directions may collide. To avoid dangers of the latter kind, two methods of operation are open, which are discussed. The dispatching system, and the block system, with either automatic signals or the train staff.—*Eng. News*, Aug. 29.

Interurban Railway.—An illustrated description of the Toledo & Monroe high-speed electric railway, with high-tension three-phase current transmission and converter sub-stations.—*Elec. Rev.*, Aug. 31.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

Single-Phase System.—WARRILOW.—An article in which he advocates the single-phase system and says that, by reason of its simplicity, it can and will be worthy of introduction as a standard method of generation and distribution. The chief drawback to single-phase supply up to the present has been its unsuitability to operate tramways directly and to meet the demands for motors of

large power. He thinks that while the chief problem is that of the tramways, it will not be so in future, as tramways of all kinds may be superseded by the automobile. He does not think that it is a great drawback that single-phase alternating currents cannot be used directly for charging storage batteries, as it is a small matter to drive a direct-current dynamo with a single-phase motor. Three-phase generation and direct-current distribution is said to be a "very doubtful method of obtaining electricity," as it lacks reliability and occasions greater outlay and maintenance. The original single-phase motor difficulty has proved to be of temporary nature, as single-phase motors are now obtainable with a good starting torque, and of high efficiency. "The field, then, lies before the single-phase system, which may be so far improved to meet the necessary demands, with the greatest simplicity at the least cost, items which form important factors in methods of generation and distribution, which our experience will teach us should be adopted as a standard for all electrical work."—Lond. *Elec. Eng.*, Aug. 23.

REFERENCES.

British Lighting Plant.—An illustrated description of the electric lighting plant of Luton. There are three 85-kw steam dynamos, a 42-kw steam balancer, and two batteries, each of 140 cells of the Chloride type, each giving 160 or 100 amperes for two or four hours, respectively.—Lond. *Elec. Rev.*, Aug. 23.

Lightning Arresters.—MUELLER.—An illustrated article on the charge of overhead lines with static electricity and on the construction and installation of lightning arresters.—*Elek. Zeit.*, July 25.

WIRES, WIRING AND CONDUITS.

India Rubber Strip for Insulation Purposes.—TERRY.—The pure rubber strip which finds application either as the first coating of power and light cables, or which is used alone for jointing in house wiring, is of two distinct makes, known as "cut" and "spread." Whereas at one time cut sheet was more largely used than spread, the reverse is now the case. This is due to motives of economy. The raw material is the same in either case. It is only after the initial stages of washing and drying that the methods of manufacture of the cut and the spread sheet begin to differ. A brief review of these methods is given. The manufacture of the cut sheet requires a large amount of expensive machinery and great care in the technical details, and is also somewhat dependent upon the conditions of the weather. In recent years, in continental Europe, "the time-honored English process of using only fine Para rubber seems early to have been abandoned, the idea asserting itself that the adulterations which were customary in the bulk of rubber goods, might be introduced with advantage into fine cut sheet also." No systematic tests appear to have been made regarding the electrical constants of first, second and third quality of cut sheet. It is still an open question how far the mechanical treatment which the rubber undergoes in the cut sheet process effects its longevity. Raw rubber as imported is practically imperishable when it is kept away from the insiduous action of the solar rays. As far as his experiments in the matter have gone, there seems no doubt that the less the rubber is exposed to mechanical action, the greater is its longevity when exposed to the various deleterious influences with which it meets when put into use.—Lond. *Elec.*, Aug. 23.

REFERENCES.

Wiring Accessories.—BOENNINGHOFEN.—A paper on wiring accessories, used by the Gen. Elec. Co., of Berlin, for aerial wiring with copper or aluminum wires for pressures up to 1000 volts. He remarks that experience in practice has already proven that aluminum cables can be successfully used. At a specific gravity of 2.7 for aluminum the specific conductivities of aluminum and copper are in the ratio 1 to 1.7, so that to get the same resistance the cross-section of aluminum must be 1.7 times that of copper. With bare wires there is a saving of 35 to 40 per cent with the use of aluminum. Moreover, as the weight is decreased, the poles can be placed at larger distances. He describes a large number of joints, lugs, insulators, etc., used by his company. The paper is fully illustrated.—*Elek. Zeit.*, Aug. 8.

Underground Mains.—An illustrated description of a new system of electric underground cables, which has been devised by Highfield and Cater, and is now undergoing a practical trial at St. Helens. The principal claims are: Small space occupied in the ground; no surface drawing-in boxes required; cheapness and rapidity in making house connections; thorough protection of conductors from all kinds of mechanical damage; a perfectly symmetrical system of conductors for polyphase systems.—Lond. *Elec. Rev.*, Aug. 23.

Cable Manufacturing Plant.—In a continuation of the serial on the visit of the (Brit.) Inst. Elec. Eng. to Germany, a well illustrated description of the cable works of the General Electric Co., of Berlin, is given.—Lond. *Elec.*, Aug. 23.

Dangers from Electric Wires to Firemen.—MEAD.—An abstract of a paper on the dangers of electric light and trolley wires to firemen when fighting fires and how to avoid these dangers.—*Eng. News*, Aug. 29.

ELECTRO-PHYSICS AND MAGNETISM.

Coherers.—ECCLES.—The first part of an account of what appears to have been a very extended series of experiments with filings coherers, the first object of which was to investigate the relative influences of oscillatory and of steady p. d.'s in promoting coherence in filings coherers. His first experiments showed that there can be no doubts as to the possibility of coherence by the application of absolutely non-oscillatory e. m. f.'s. Moreover, it was established that any electrical surgings produced by sudden connection with the source of e. m. f. had little or no influence in compelling coherence beyond that which their maximum voltage gives them; in other words, coherence was found to be an effect caused merely by p. d. There were great difficulties in his experiments regarding the relation between sensitiveness and cohering voltage, these difficulties being due to mechanical disturbances. He endeavored to make the degree of mechanical disturbance as uniform as possible. This was done by allowing the hammer of a trembler to strike uninterruptedly the coherers under examination. During each quiescent stage between the blows coherence takes place and a current passes through the galvanometer. Decoherence follows immediately, and is succeeded by another coherence, and so on. If uniformity of the vigor of the blows is ensured, each consecutive cycle of operations within the coherer, resembles accurately the preceding one. The galvanometer gives the mean value. This method was very successful. Sevral diagrams, showing the relation between the milliamperes obtained and the voltage applied, are given. The article is to be continued.—Lond. *Elec.*, Aug. 23.

Elements of Three-Phase Theory.—RUSSELL.—A mathematical article, illustrated by diagrams, in which he discusses several fundamental theorems of three-phase theory, without making any assumption as to the shape of the wave form. The problems considered are the following: He shows how to calculate the magnitudes and the phase differences between the mains in three-phase systems, and gives a graphical representation of the voltages in the three arms of the load, with star connection. He gives a rule for finding the voltages across the arms of a star-box when the resistances of the arms are given, and an algebraical formula for finding the angles of the voltage triangle. "The voltages in a star box adjust themselves so that the energy expended in it is a minimum." He then discusses the potentials to earth of the mains. "If the fault resistances of the mains vary, then their potentials adjust themselves so that the energy expended in leakage currents is a minimum." He gives a simple rule for constructing the diagram of the currents in a mesh winding, and discusses the measurement of power in three-phase circuits. He finally discusses some special theorems, namely, to find the resistances of the arms of a star-box in order to get symmetrical three-phase currents, and, to find the ratio of the resistances in the star winding in order that the voltages to the center may be equal.—Lond. *Elec.*, Aug. 16.

Braun's Cathode Ray Tube as Electrometer.—MILHAM.—An account of experiments in which he used the Braun cathode ray tube for measuring electrostatic fields. His method is necesarily somewhat indirect, for when the tube is placed between the electrodes there is no deflection of the cathode ray beam; when, however, the field is suddenly commutated, the fluorescent spot jumps aside, and then returns to its normal position, quickly at first, and then more slowly. On repeating the commutation the throw is in the opposite direction, and the return is as before. The following explanation is suggested. The field traverses the tube, but the cathode rays within the tube render the gas conducting, and the charges on the walls are thus neutralized. That this is the true explanation, may be proved by interrupting the cathode rays during their returning motion by stopping the current. The luminous spot then disappears, and when the beam is restored the spot reappears, not in its normal

position, but at the point it had reached when the rays were cut off. The speed of return is proportional to the throw, and the latter is proportional to the field. Under favorable conditions he claims an accuracy within 1 per cent for the measurements.—*Phys. Zeit.*, Aug. 3; abstracted in Lond. *Elec.*, Aug. 23.

Discharge Current from a Surface of Large Curvature.—ALMY.—An account of an investigation in which he found that the current discharging from a fine wire to a concentric surrounding cylinder is proportional to the product of the length of the discharge wire, the potential difference between wire and cylinder, and the difference between this potential difference and the minimum potential necessary to produce a measurable discharge, and inversely proportional to the third power of the radius of the cylinder.—*Am. Jour. Sc.*, Sept.

ELECTRO-CHEMISTRY AND BATTERIES.

Edison's Alkaline Storage Batteries.—WADE.—A description, taken from the patent specifications of Edison's cadmium-copper and iron-nickel cells. He also makes some general remarks on the latter cell. He says that Edison's claim that iron cannot decompose water is correct, as the e. m. f., corresponding to the oxidation of iron and calculated from the thermochemical value of the oxidation heat, is 1.47, while the minimum e. m. f. required to decompose water is 1.48. Edison has found that iron in a finely divided form, when prepared by the usual known methods, is practically unoxidizable. Kennelly has described this by saying that iron assumes the well-known passive state. The present author remarks that it is questionable whether this is not to confuse two phenomena which, while superficially alike, are really of a different or even opposing nature, for it is generally believed that the metal is protected from the acid by a thin skin of oxide on its surface; that is to say, the passive state of iron is the result of oxidation rather than of inability to oxidize. "The important fact whose discovery is the essence of Edison's invention is that, while most forms of iron cannot be oxidized and most salts of iron cannot be electrolytically reduced in an alkaline solution, there are a very few which will reduce to the metallic state and oxidize again with comparative facility."—Lond. *Elec.*, Aug. 23.

Max Storage Battery.—CASNIER.—An illustrated description of the Max storage battery, made by a French firm. The battery is of the Faure type. The electrodes consist of a series of cylinders of about ¼ inch diameter. Each cylinder has a lead core covered with active material, which is again covered with a layer of moist asbestos. "The asbestos used is blue asbestos, which gives results apparently much superior to the ordinary white asbestos." The construction of the electrodes in form of a series of cylinders is said to ensure a longer life than other types of light pasted batteries. The whole battery is manufactured mechanically by means of a special machine which is described and which turns out about 40 electrodes of 8.7 inches length and ¼ inch diameter per minute. Tests of the battery, made in the Central Laboratory of Electricity, have given the following results: The capacity in watt-hours is 290, 252, 211 for a discharge of 7¼ hours, 4¾ hours, 2¼ hours, respectively. This corresponds to 25.8, 22.2 and 18.6 watt-hours per kilogram, as the total weight of the tested battery was 11.35 kilograms, the weight of the electrodes alone being 7.11 kilogram.—*L'Ind. Elec.*, July 25.

REFERENCES.

Historical.—Some historical notes on the beginnings of electro-chemistry. The suggestion to work chemical reactions by electricity is due to Cruikshank, but the first important application of the idea—the discovery of new metals—belongs to Davy. An account of Davy's experiments is given. Reference is made to the investigations of Faraday, Hittorf and Kohlrausch, and to the theories of Grotthus, Clausius and Arrhenius.—*The Elec. Chem and Met.*, Aug.

Persulphates.—PERKIN.—An article on the preparation by electro-chemical methods, of persulphate and of persulphuric acid, and on their properties.—*The Elec. Chem. and Met.*, Aug.

UNITS. MEASUREMENTS AND INSTRUMENTS.

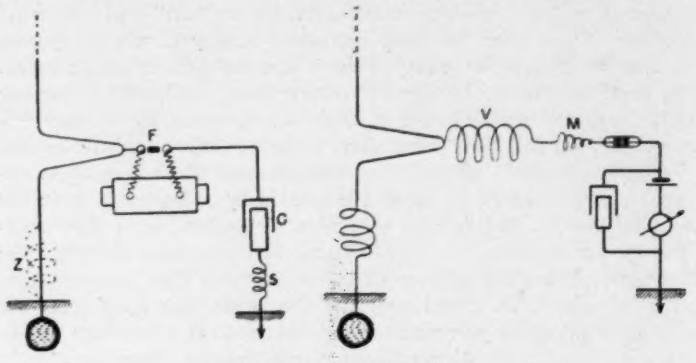
Eddy Current Brakes.—FEUSSNER.—A long illustrated paper read before the Electrotechnical Society, of Berlin, in which he describes the construction of several forms of eddy current brakes for testing machines, more especially of two made by the German Reichsanstalt. The principle of the eddy current brake is an old one, and has been used in many motormeters. A copper disk is revolved in a magnetic field. Eddy currents are induced in the copper disk, and a torque is produced which tends to revolve the system of magnet poles in the direction of the rotation of the copper disk. The copper disk is connected to the motor, the power of which is to be measured. The system of the magnet poles is so arranged that it can revolve by a small angle around the same axle in space as the copper disk. The force acting upon the system of the magnet poles is measured by balancing it by means of weights as in scales. The methods of artificially cooling the induced part are described. The main advantage of eddy current brakes over friction brakes is that the desired load can be exactly fixed, and that very delicate measurements can be made. He used battery current. The needles of the ammeter and voltmeter by which he measured the power consumed by the motor did not oscillate the least, so that exact readings to one or two thousandths could be made.—*Elek. Zeit.*, July 25.

REFERENCE.

Wattmeter.—CARMICHAEL.—An illustrated description of the Thomson recording wattmeter.—*Can. Elec. News*, Aug.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Wireless Telegraphy.—SLABY.—An abstract of a paper on "The latest progress in spark telegraphy." The connections used in the transmitter and receiver by the Gen. Elec. Co., of Berlin, are given in the adjoining diagrams 1 and 2, respectively. The transmitter consists of the vertical wire fastened to the flagstaff of the building, which is led to earth and connected with the water main. A loop in this wire is led through the window into the room and is connected to an induction coil *F*, the other pole of the secondary winding being connected to earth through a tuned condenser *C*. The wave-length to be transmitted can be changed by adding a coil of wire *Z* in the earth wire, as indicated by the dotted line in the diagram. A whole set of such coils is at hand, so that a large number of different wave-lengths can be transmitted. In each case, however, it



DIAGRAMS OF CONNECTIONS.

is necessary to tune the oscillations produced on the circuit closed by the earth connection to the oscillation of the wire, in order to obtain the greatest effect. This is done in the simplest manner by adjusting an adjustable self-induction *S* or the condenser *C*. Diagram 2 shows the receiver. The pressure is at its maximum at the end of coil *V*, and "is strengthened by a tuned intensifying coil *M* which is connected directly to the coherer." It is also possible to replace the action of the two coils by a single coil with corresponding winding. The earth connection of the coherer contains the dry cell and the relay, which are bridged by a condenser in order not to disturb the oscillations. The General Electric Company, of Berlin, guarantees with this arrangement a tuning to the required wave-length "within certain limits," and a clear deciphering of signals at distances of 60 miles on the sea with masts 164 ft. high. He remarks that wireless telegraphy has left the condition of tentative experiment. It will become an indispensable means of communication on the coast and on the open sea, and "will also, in future, replace cable in many cases for submarine communications, although in this respect we must not place our hopes too high." "We can scarcely expect a transmission of signals of more than a few hundred kilometers even with more perfect development of the means at present at hand." He remarks that the future of wireless telegraphy "lies exclusively in the direction of producing higher electrical pressures. What we have used in this direction hitherto is very modest, if we compare it with what has been shown to only a few of the initiated, far from here on the other side of the ocean, on the high Rocky Mountains at the sources of the Colorado River, by an investigator who has shut himself off from the world—Nikola Tesla. . . . May his theoretical knowledge and his eminent technical ability

soon be placed at the practical service of spark telegraphy." A reproduction of a very peculiar photograph is given which shows Tesla sitting in his laboratory. There are cylinders of different heights, and a globe suspended near the roof. The whole is filled with heavy spark discharges starting from the cylinders and the globe.—Lond. *Elec.*, Aug. 23.

Multiplier.—BLONDEL.—A brief communication referring to Slaby's wireless telegraphy experiments, and the theory of Seibt on the action of the "multiplier" (Digest, Aug. 24), used by Slaby (the coil *M* in the above figure 2). He says that only the theory of Seibt is new, while the multiplier itself is well known in France to physicists and physiologists under the name of the Oudin resonator. —*Elek. Zeit.*, Aug. 22.

CAHEN.—A communication in which he corrects a slight mistake in the theory of Seibt, which, however, does not alter the final result. *Elek. Zeit.*, Aug. 8.

MISCELLANEOUS.

REFERENCES.

Electric Furnaces.—RICHARD.—An article giving brief illustrated descriptions of electric furnaces, devised by Borchers, Gin and Leleux, Roesler and Carlson, Contardo, Electro-Chemical Society Volta, the Machalske furnace for preparing phosphorus, the Hatch rotary furnace, and the Voelker and Luhne furnace for making glass. —*L'Eclairage Elec.*, Aug. 17.

Canadian Manufacturing Plant.—An illustrated article on the plant of the Canadian General Electric Company at Peterboro, Ont.—*Can. Elec. News*, Aug.

Manufacturing Plant.—An illustrated description of the works of the Westinghouse Electric & Manufacturing Company in Pittsburg. —*Sc. Amer.*, Aug. 31.

Glasgow Exhibition.—An illustrated description, by Wansbrough, of the electric light plant and an illustrated description by Horner, of the machine tools exhibited.—*Cassier's Mag.*, Sept.

KERR.—An illustrated article on engineering at the Glasgow exhibition, in which he deals with the salient points in the steam plant and machinery section.—*Eng. Mag.*, Sept.

Paris Exposition.—REYVAL.—Illustrated descriptions of alternating-current machinery, exhibited by the Oerlikon Company; a 650-kilovolt-ampere, 7500-volt, three-phase alternator, a 200-kw synchronous converter, several three-phase induction motors, and a 20-kilovolt-ampere, three-phase transformer.—*L'Eclairage Elec.*, July 20. Illustrated descriptions of direct-current dynamos of 65 kilowatts and 6 kilowatts, a 7-hp, three-phase induction motor, and a 3-kilovolt-ampere, three-phase transformer exhibited by Krizik, also of 200-kw, direct-current machines exhibited by Breguet.—*L'Eclairage Elec.*, Aug. 3. An illustrated description of a high-tension 180-kilovolt-ampere, single-phase alternator of the Societe L'Eclairage Elec. The voltage is 30,000. For a frequency of 50 p. p. s. the speed is 428 revolutions. The number of poles is 14.—*L'Eclairage Elec.*, Aug. 10.

New Books.

THEORETICAL ELEMENTS OF ELECTRICAL ENGINEERING. By Charles Proteus Steinmetz. New York: Electrical World and Engineer. 320 pages, 148 illustrations. Price, $2.50.

The preface states that the first part of this volume, entitled "General Theory," grew out of a series of University lectures which the author once upon a time promised to deliver. This section of the book may, in a sense, be considered as an introduction to the author's classical work on "The Theory and Calculation of Alternating-Current Phenomena," leading up gradually from the ordinary sine wave representation of the alternating current to the representation by polar co-ordinates, to the representation by polar vectors, and to the symbolic representation in terms of the rectangular components of these polar vectors. The section is, however, more than an introduction to the author's large work, inasmuch as it treats of the fundamental principles of both direct and alternating current.

The second section, entitled "Special Apparatus," is a series of monographs upon the more important types of alternating and direct-current apparatus. This part is to some extent supplementary to "Alternating-Current Phenomena," in which the author has presented the general theory of alternating-current machines, while the present work is devoted more especially to specific discussions of the particular features of individual machines. This section is, therefore, less theoretical and more descriptive than "Alternating-Current Phenomena," the characteristic features of structure and behavior being covered.

The work is restricted to those machines which experience has shown to be of practical importance, and to those theories and methods which are of practical utility. This is the more desirable inasmuch as electrical literature has been, especially of late years, haunted by so many theories which are either incorrect or too complicated for use.

The above statements as to the scope and character of the book will give an idea of the contents of a work which makes a distinct addition to the debt, already large, which electrical engineers owe to the talented author.

BOOKS RECEIVED.

ELECTROMAGNETS; THEIR DESIGN AND CONSTRUCTION. By A. N. Mansfield, S. B. New York: D. Van Nostrand Company. 155 pages, 36 figures. Price, 50 cents. (Science Series.)

DIE NEUSTEN FORTSCHRITTE AUF DEM GEBIETE DER FUNKENTELEGRAPHIE. Von A. Slaby. Berlin: Julius Springer. 30 pages, illustrated. Price, 80 pfennigs.

ORIGINAL PAPERS BY THE LATE JOHN HOPKINSON, D. Sc., F. R. S. Edited, with a Memoir, by B. Hopkinson, B. Sc. Two volumes. Vol. I., Technical Papers. Vol. II., Scientific Papers. Cambridge: University Press. Vol. I., 294 pages; Vol. II., 393 pages.

Directory of Electrical Societies, Etc.

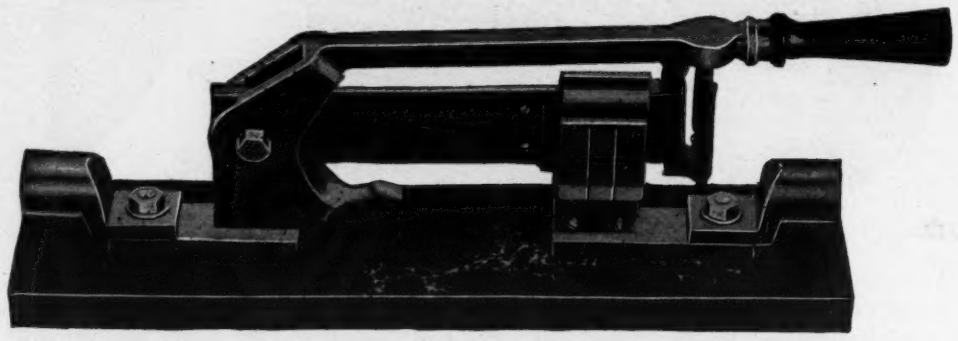
ILLINOIS STATE ELECTRIC ASSOCIATION. Next meeting, Rock Island, Ill., Sept. 24 and 25, 1901.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Next meeting, Owensboro, Ky., Oct. 8 and 9, 1901.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Next meeting, Buffalo, N. Y., Sept. 24, 25 and 26, 1901.

A New Quick Break Switch.

We show herewith a new quick break switch now being made by Zimdars & Hunt, of New York City. It is claimed to be a strictly high grade switch, one that will meet the severe service to which this type of apparatus is so often subjected. The cut illustrates clearly the principal features of the design. The handle lever is connected with the blade by spiral springs. In the act of opening, these springs are fully elongated before the blade moves, but at that moment the blade is started by the finger on the lower end of the handle lever, and then under the action of the springs, flies out instantly and an instantaneous break is effected. There is no arcing at the main contacts, however, this being taken care of by auxiliary carbon contact blocks, which are supplied on all these switches. The switch gives evidence of careful design, and the manufacturers state that owing to the liberal contact and sectional areas provided there is no possibility of undue heating even under a considerable overload.



QUICK-BREAK SWITCH.

American Electro-Therapeutic Association.

The eleventh annual meeting of the American Electro-Therapeutic Association will be held at Buffalo, N. Y., on Tuesday, Wednesday and Thursday, Sept. 24, 25 and 26.

Electrical Test Instruments.

The accompanying illustrations show several new types of testing instruments manufactured by Elmer G. Willyoung, 11 Frankfort Street, New York. Fig. 1 is known as "Model K" portable test set, and replaces the well-known "Aone" Test Set, of which it is a modified and improved form. It is claimed that the "Model K" is arranged for a larger variety of measurements than any other single instrument that has ever been offered. Among the possible measurements are resistances in general; very high resistances; very low resistances; insulation (as in cable testing) by the direct deflection method; internal resistance of batteries; the measurement of e. m. f.; calibration of ammeters and voltmeters; location of faults by the Varley or Murray loop method; the measurement of self-induction; detection of open and short circuits, etc., etc. Familiarity with testing methods will suggest many other possible tests. It is not claimed that any one of the above tests is better made with the "Model K" than with other type of instrument that might be named, but it is claimed that where only one or a few instruments is possible to an expert, the type mentioned can be the least easily dispensed with.

The set is really a highly developed form of Wheatstone bridge. There are 17 coils in all, arranged 1, 2, 3, 4, 10, 20, 30, etc., to 10,000 inclusive. The bridge arms proper are reversible, with ratio coils of 1, 10, 100, on one side, and 10, 100 and 1000 on the other. The maximum range of measurement is, therefore, from 0.001 ohm to 21 megohms. By using the "direct deflection" method, this maximum is extended up to about 200 megohms. The set is complete with its own galvanometer and battery. The former is a jeweled D'Arsonval instrument, absolutely unaffected by mechanical or electrical disturbances, and giving a deflection of one division per volt through from 1½ to 2 megohms. The galvanometer scale is long (1½ inches), zero in the center, and with 30 divisions on each side. Deflections are strictly proportional to current.

For the "Loop" tests, a special "ground" plug is used. For the "Direct Deflection" method, the set has its own galvanometer shunts. (See upper left-hand corner of Fig. 1.) These shunts are contained in a little nickeled box which attaches to the set proper by four screws—two of these screws making the connection. This

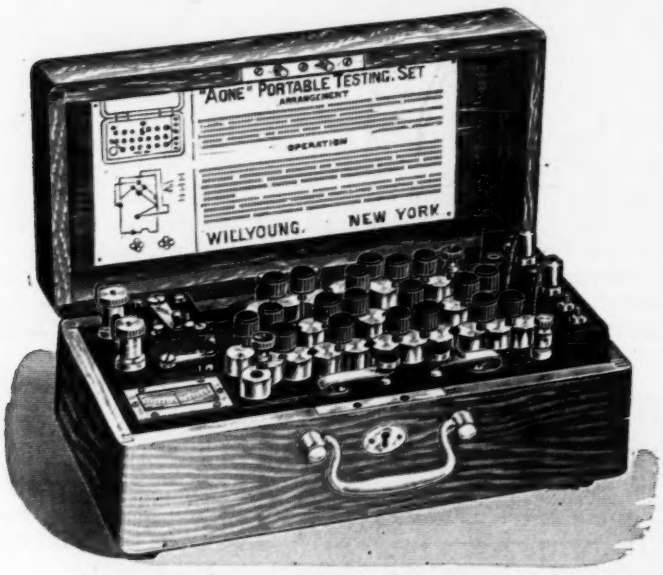


FIG. 1.—PORTABLE TESTING SET.

shunt box is interchangeable in all sets, and may, therefore, be purchased with the set or not, as may be decided. This type is said to be the smallest (11 by 5¼ by 4½ inches deep) instrument of its kind ever put upon the market, as also the lightest (weighs 7 lbs.).

A photometer known as "No. 1 Station Photometer" is shown in Fig. 2. This instrument has been upon the market for the past four years, but the present model embodies a large number of minor improvements recently made. This photometer is essentially for accurate measurements either in the factory, central station, or scientific laboratory. The track is of cold rolled steel shafting supported by pillars at each end. It carries an engine divided scale reading direct in candle-power. Either a plain (for mean hemispherical candle-power) or a compound rotator (for spherical candle-power), is at one end and carries the lamp under test. At the other end is a support which will carry either an amyl-acetate standard or a standard incandescent lamp. The observing carriage is equipped, ordinarily, either with a Lummer-Brodhun or a Bunsen screen. This carriage has a quick-acting clamp below, by which it may be instantly clamped

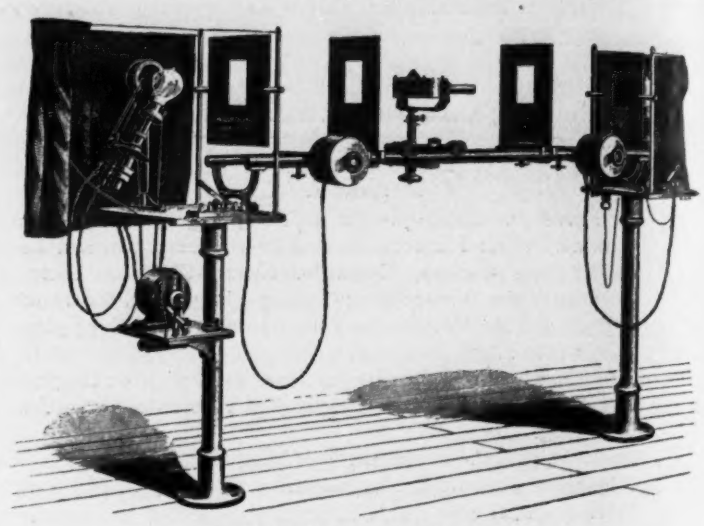


FIG. 2.—STATION PHOTOMETER.

to the track at any desired point; a ½-cp incandescent lamp (placed in series with an outside 110-volt, 16-cp lamp) illuminates the scale and permits it to be read when a button is depressed. There is a finely divided rheostat for each lamp, carrying current up to 1½ amperes and varying the voltage continuously for about 20 per cent on each side of the normal. These rheostats are attached to clamps which may be slipped along the track and fastened at any desired point. This permits the observer to regulate both lamps himself or allows him to use assistants at the ends of the track, as he may prefer.

Fig. 3 is a faradmeter for measuring electrostatic capacity. It is really a Wheatstone bridge arranged on the Varley slide scheme, and with its resistances free of capacity and inductance. An alternating

FIG. 3.—FARADMETER.

current or an induction coil running at small spark length (1-16 to ⅛ inch) is the source of current, and a telephone is the detector. There are two switches, one giving the first and the other the second decimal place. They are set quickly, and are direct reading. This instrument is therefore a commercial instrument which any one may use, there being no galvanometer to keep in adjustment, and electrical and mechanical disturbances do not affect it—in short, it is a labor-saving device. It is claimed that a tyro can do 10 times the

work with it that an expert can do with a ballistic galvanometer in the same time. Not the least of the advantages claimed for this instrument is that absorption and leakage are eliminated, i. e., the capacity is not a matter of defining exactly the time of change, discharge, etc., but is always the same for the same condenser.

A Novelty in Electric Signs.

The demand for electric signs appears to be very much on the increase, and there is a corresponding effort to fill it. As a general thing, such signs have been costly and elaborate, while many people want and are satisfied with methods involving only a moderate outlay. A recent successful effort to produce a cheap electrical advertising sign has been made by the American Miniature & Decorative Lamp Company, 436 Broome Street, New York, as illustrated herewith in Figs. 1, 2 and 3, which are reproduced from actual signs. It should be stated that the lamps are arranged in a circle of wood coated with fine white enamel in which a varying number of special 8-cp lamps are set. The sizes made at present, include 15, 12 or 8 lamps in multiple, and 16 or 8 in series. Each ring is furnished with cord and plug, and can be instantly connected up to any convenient socket. If the cost of running two ordinary 16-cp lamps for 5 hours nightly be taken at $2 per month, such a sign, which is far more effective for advertising purposes, should pay for itself in four months. We understand from the management that other shapes are now being built, embodying the same idea of encircling or enclosing the "ad" with a rim of powerful light. Of course, the textual sheet in the center can easily be changed at any time. The 8-cp lamps used are of a special design, and are, it is said, much smaller than anything of the kind previously attempted.

FIG. 1.—ELECTRIC SIGN.

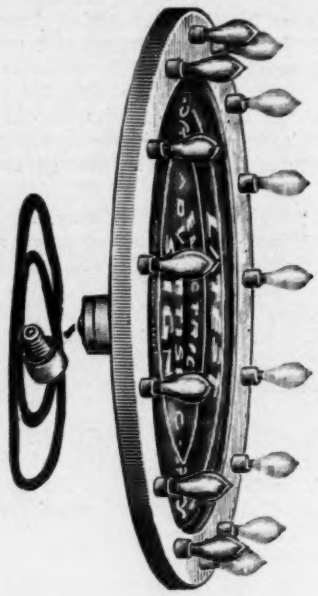


FIG. 2.—ELECTRIC SIGN.

FIG. 3.—ELECTRIC SIGN.

Exhibits at the Municipal Convention.

At the Niagara Falls Convention of the Association of Municipal Electricians, report of which appears elsewhere in this issue, a few exhibits were made, a room being set apart for the purpose:

THE CIRCULAR LOOM COMPANY, of Boston, was represented by F. N. Ferrin.

THE OKONITE COMPANY, of New York, was represented by George T. Manson.

THE GORDON BATTERY COMPANY, of New York, was represented by W. C. Banks.

J. JONES & SONS, of New York, were represented by Mr. J. Jones, and their exhibit was an elaborate one.

THE CARBORUNDUM COMPANY, of Niagara Falls, N. Y., distributed pocket knife sharpeners made of its product, which is a "keen" rival to the emery-wheel.

THE SAFETY INSULATED WIRE AND CABLE COMPANY, of New York, was represented by A. P. Eckert, who distributed leather-covered memorandum books.

THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY, of New York, was represented by T. Torry, who gave away as a souvenir a silver matchbox of unique design.

THE EDISON MANUFACTURING COMPANY, of Orange, N. J., was represented by W. S. Logue, of Chicago, the general manager of the Edison interests at that point.

MR. LOUIS W. MILLER, superintendent of fire-alarm telegraph at Rochester, N. Y., explained the merits of the Miller cut-out, which absolutely cuts out, when they are not in use, fire and police telegraph boxes. Mr. Miller's device is in use in many cities, and he is at present installing a full set of these instruments at Syracuse, N. Y.

THE MONTAUK FIRE DETECTING WIRE COMPANY, of New York, was represented by Mr. F. S. Palmer, of the New York office. An interesting exhibit was given, showing the practical operation of the system in affording prompt fire alarm. The fire that was detected was effectually suppressed by the application of "Kilfyre." This exhibition was given in front of the hotel, and was witnessed by several hundred people.

THE SPRAGUE ELECTRIC COMPANY, of New York, was represented by Alexander Henderson. The conduit exhibit was a very complete one and highly interesting. Greenfield flexible steel conduits and steel armored conductors were shown, and samples of these goods were distributed among the members. A large sample board originally built for the Pan-American Exposition attracted a good deal of attention. Mr. Henderson was the first chief of the electrical inspection bureau of the Fire Department of New York City, and is deservedly popular with municipal electricians as well as with other folk.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Call money closed at 4 per cent; time money, 5 per cent for 60 days. There was a violent break in prices on the stock market on Saturday as a consequence of the attempted assassination of President McKinley at Buffalo on Friday afternoon, and the market exhibited a feverish tendency, closing near the low, very weak opening prices. Part of the weakness at the close was, however, attributed to the heavy decrease in the bank return, which was $10,000,000 instead of $5,000,000, as previously estimated. The market up to Friday's close was irregular and sensitive about money conditions. Steel stocks showed some strength, notwithstanding the disappointment over the non-settlement of the steel strike. The industrial list, while not active, exhibited some features of interest. In the tractions, Brooklyn Rapid Transit developed weakness, owing to the fact that the July net earnings showed a falling off instead of an increase, as was predicted. Manhattan received support, owing to the excellent annual report and the increases in the earnings of the system for both July and August, but closed the week with a net loss of 6 points. In the outside market, the feature was the pressure to sell issues that have recently been most active. At Saturday's close the following results of the week's transactions in the principal traction and electric issues were recorded, all being affected unfavorably by the shooting of the President. There were sales of 288 shares of American Telegraph & Cable at 99, which was ¼ point higher than the last recorded sale several weeks ago; 800 shares of American Telephone & Telegraph were sold at prices ranging between 165 and 167¾, closing with a net loss of 2½ points. The sales of Brooklyn Rapid Transit aggregated 65,980 shares, the closing price, 65¾, being 9¾ points below that of the previous week; the prices ranged between 65⅛ and 75½. Metropolitan Street Railway closed with a net loss of 6¼ points, on sales of 5815 shares at prices ranging between 162½ and 169. General Electric also suffered a big drop, the net loss being 13¾ points on a range of prices between 253 to 267½. Western Union dropped 2½ points, the total sales for the week being 4350 shares, and the range of quotations 90¾ to 93½. Following are the closing quotations of Tuesday, Sept. 10:

NEW YORK.

	Sept. 3.	Sept. 10.		Sept. 3.	Sept. 10.
American Tel. & Cable...	—	—	General Carriage.....	½	¾
American Dist. Tel.....	—	—	Hudson River Tel.....	120	120
Brooklyn Rapid Transit..	75	68¼	Illinois Elec. Veh. Trans.	—	—
Commercial Cable.....	—	—	Metropolitan Street Ry..	167½	165⅞
Electric Boat.....	23	20	N. E. Elec. Veh. Tran...	—	—
Electric Boat pfd.....	48	47	N. Y. Elec. Veh. Tran...	10½	10
Electric Lead Reduc'n...	1½	2	N. Y. & N. J. Tel.....	168	168
Electric Vehicle.....	5½	5½	Tel. & Tel. Co. of Am...	5	5
Electric Vehicle pfd.....	10	8	Western Union Tel.....	93⅛	92⅝
General Electric.....	267½	264			

BOSTON.

	Sept. 3.	Sept. 10.		Sept. 3.	Sept. 10.
Am. Tel. & Tel.....	166	164	Mexican Telephone.....	2½	2⅜
Cumberland Telephone...	—	—	New England Telephone.	—	—
Boston Electric Light...	250	250	Westinghouse Elec.....	—	—
Erie Telephone.....	42	35	Westinghouse Elec. pfd..	—	—
General Electric pfd.....	—	—			

PHILADELPHIA.

	Sept. 3.	Sept. 10.		Sept. 3.	Sept. 10.
American Railways.....	40¾	40½	Phila. Traction.....	97½	97⅜
Electric Storage Battery..	72	70	Philadelphia Electric.....	6	5½
Elec. Storage Batt'y pfd.	72	70	Pa. Electric Vehicle.....	¼	½
Elec. Co. of America....	7⅛	7⅛	Pa. Elec. Veh. pfd.....	¼	½

CHICAGO.

	Sept. 3.	Sept. 10.		Sept. 3.	Sept. 10.
Central Union Telephone.	—	—	National Carbon pfd....	—	84¼
Chicago Edison.....	—	165	Northwest Elev. com....	—	39
Chicago City Ry.....	206	206	Union Traction.....	—	17⅛
Chicago Telep. Co.....	—	275	Union Traction pfd.....	—	58
National Carbon.....	18	18			

TELEPHONE, TELEGRAPH & CABLE CO.—A director of the Telephone, Telegraph & Cable Company of America says that the offer of Charles W. Morse to purchase the capital stock of the company is not in the interest of the American Bell Telephone & Telegraph Company, or any other organization, but purely a business venture of Mr. Morse who is a firm believer in independent telephony. A number of the largest holders of stock have already deposited their stock with the trust company and the full amount—at least two-thirds—will probably be deposited before this journal appears. Mr. Morse will immediately reorganize the company and appropriate $3,000,000 of money to build up the independent system in New York and Boston, including the construction of a line between the two cities. Five million dollars additional money has been provided for to carry the plans through to a finish as rapidly as possible. The long distance and exchange service will cover the principal cities and towns of New England. Mr. Henry Wilson will retire from the directory of the Erie Telegraph & Telephone Company and Mr. Morse will name a successor to represent his interest in that corporation. Two factions are giving Erie Telephone considerable attention in the market just now, seeking to obtain a controlling interest in the corporation.

PHILADELPHIA BELL TELEPHONE has been more active in the last two weeks than for some time. The sales, however, have not been very large, aggregating only 185 shares last week, and 100 shares the week before. The price has held firm at 72½. It is supposed that the holders were influenced to sell by the growing activity of the Keystone Telephone Company in the local field. The Keystone, with $10,000,000 authorized capital, has $2,500,000 subscribed and about $600,000 paid in. Good progress has been made by the new company, in the laying of conduits and cables, as well as in obtaining subscriptions. The Keystone Company is understood to have obtained over 5000 subscribers. The Bell has about 14,000 subscribers.

SCHENECTADY RAILWAY BONDS.—Perry, Coffin & Burr and N. W. Harris & Co., jointly, have purchased $1,250,000 Schenectady Railway Company, 4½ per cent first mortgage 40-year gold bonds, due September 1, 1941, but callable at 110 and interest after 10 years. The proceeds will pay for the double track extension recently completed to Albany, for the line under construction to Troy, and for extensions and improvements to the railway and illuminating properties in Schenectady. The Schenectady Railway Company controls the entire railway and electric lighting business of Schenectady. Its capital stock is owned by the General Electric Company. Further extensions are contemplated. The Mercantile Trust Company, New York, is trustee for the bonds.

DECLINE IN ERIE TELEPHONE.—The recent decline in Erie Telephone to 40 is attributed to the fact that the company has been obliged to borrow $1,500,000 additional money from the Old Colony Trust Company syndicate for construction purposes. Of the $7,500,000 furnished by this syndicate the early part of the year only $1,000,000 was provided for needed extensions and improvements. This additional $1,500,000 is raised through the issue of 5 per cent notes, which have been underwritten by the syndicate managers at 99 and accrued interest, and makes the total amount of short-term notes now outstanding $9,000,000, all of which expire January 10, 1902. The security back of this additional money furnished consists of notes or stock or both of the subsidiary companies.

MANHATTAN ELEVATED.—The Manhattan statement shows after paying 4 per cent for the year ending June 30, a surplus of more than $400,000. July, one of the poorest months of the year, showed $53,000 increase and August $68,000 increase over the corresponding months of last year—a total of $121,000 for the two poorest months of the year. If Manhattan, with its old power, can make such a showing as this, very much better results are to be expected when it is electrically equipped. The first generator is now being set up.

MORTGAGE.—The Birmingham Railway, Light & Power Company, Birmingham, Ala., has filed a mortgage and deed of trust to the Old Colony Trust Company, of Boston, for $6,000,000. Of this sum $2,000,000 will be placed aside for future use and $2,250,000 are to be sold for immediate use, and of this sum $1,000,000 is to be sold at not less than 77½, to be used for the purpose of construction to the extent of 75 per cent of the value. This deed represents the final step in the previously mentioned consolidation of the electric railway, light and gas interests.

GRAMOPHONE COMPANY RECEIVER.—Application was made to Justice Herrick in Special Term of the Supreme Court, Brooklyn, last week, and by him granted, for the dissolution of the National Gramophone Company, and the appointment of a temporary receiver on the ground that the corporation is insolvent. A receiver will be agreed on this week.

DIVIDENDS.—Directors of the South Side Elevated have declared a quarterly dividend of 1 per cent, advancing the stock from 3¾ per cent to a 4 per cent basis. Twin City directors have declared a dividend of 1¾ per cent on preferred stock. The directors of the Commercial Cable Company have declared the regular quarterly dividend of 1¾ per cent, payable Oct. 1.

AMERICAN TELEPHONE & TELEGRAPH stock, the old Bell telephone, was dealt in for the first time last week on the New York Stock Exchange.

PITTSBURG TROLLEY CONSOLIDATION.—It is rumored that the Mellons have offered to buy control of the Consolidated Traction system on the basis of $30 a share for the common stock and $60 a share for the preferred. The report combines all the Mellon suburban lines with the Consolidated, adding these to the lines to be constructed on the North Side, charters for which have been obtained and franchises granted. This would give the Mellons control of all the traction lines of the two cities and suburbs, with the exceptions of the Southern Traction and the United Traction, which is controlled by the Philadelphia Company.

DETROIT UNITED RAILWAY.—Circulars to stockholders state that a new company is being organized in Michigan to acquire all the railway lines of the Detroit United Railway Company. The capital stock of the new company is to be $12,500,000, and the authorized issue of bonds, $50,000,000. This is but one part of the plan to consolidate all the street railway lines of northern Ohio. Similar companies are to be formed to secure the ownership of lines in Toledo and Cleveland. Then a new company is to be incorporated under the New Jersey laws under a capital stock of $125,000,000, and all the companies are to pass under the control of one management.

RAILWAYS COMPANY GENERAL.—No official statement has yet been given out concerning the sale of the Michigan Traction Company to the Boland syndicate, of New York, but it is said that the Railways Company General received $60 a share for its 3300 shares of the total 5000 shares of Michigan Traction Company stock, amounting to $198,000. It is understood that at the Railways Company General meeting this month a dividend disbursement at the rate of 5 per cent per annum will be authorized, on the reduced capitalization of $1,200,000.

CHICAGO NORTHWESTERN ELEVATED.—Articles have been filed increasing the capital stock of the Northwestern Elevated Railway from $10,000,000 to $25,000,000. The increase is made in connection with the purchase of the Union Elevated Loop.

Commercial Intelligence.

THE WEEK IN TRADE.—Trade advices received by the mercantile agencies indicate a generally satisfactory condition of affairs. The fall demand, which is now in full blast in all sections, compares well with that of last year, and business at the South continues to expand. Specially marked features are the reports of a large seasonable distribution, heavy shipments and improved collections from leading Western centres. All the measures of trade demand point to the maintenance of general business on a scale not heretofore equaled for this time of the year. The industrial disturbances are not having as much effect as they did earlier, and despite the steel strike the trades affected are doing a large business, pig iron being in better requisition. The demand for steel and iron grows steadily and premiums for quick delivery of affected products are advancing. Gross railway earnings of 36 roads for the fourth week of August, as reported by *Bradstreet's*, aggregate $11,235,644, a gain of 12 per cent over the same week last year. Roads reporting for the month of August show earnings of $51,827,152, a gain of 13.6 per cent over last year. Business failures, while more numerous than those of the corresponding week last year, are less hurtful than they were one or two months ago, and really reflect only the normal friction inseparable from the conduct of business in a large volume. The total number for the week, as reported by *Bradstreet's*, was 169, as against 180 the previous week and 154 the corresponding week last year. There were 788 failures in August, involving liabilities of nearly $10,000,000, a decrease of 6.3 per cent in the number and of 34 per cent in liabilities from July, but an increase of 12 per cent in number and of 63 per cent in liabilities over August last year. Copper remains unchanged as to prices, Lake being quoted at 16½ cents and casting from 15⅞ cents to 16¼ cents. The exports of domestic copper from Atlantic ports for the month of August, as compiled by the New York Metal Exchange, aggregated 64,084 tons.

OUTFITS FOR GREAT NORTHERN STEAMSHIPS.—The two huge steamships which are now under construction for the Great Northern Steamship Company, at the yards of the Eastern Shipbuilding Company, New London, Conn., are to be equipped with Westinghouse apparatus for electric lighting and ventilating purposes. The contract, which has just been secured by Westinghouse, Church, Kerr & Co., provides for eight generating sets, consisting of Westinghouse compound engines of 150 horse-power each, direct connected to 75-kw generators. There will be the same number of blowing outfits. The engines, which will be direct connected to the blowers, are to be 90 horse-power each. The value of the contract is about $50,000. Electricity will play an important part in these vessels, which are being built for the Oriental trade, and several important contracts in connection with such apparatus have yet to be placed. The large cargo conveyors are to be operated by electricity. The steering gear will be of the electrical tiller type, and the winches for handling cargo will also be worked by motors. There will also be a large electrically operated ice machine of the ammonia compressor type.

AMERICAN EQUIPMENT FOR NEW ZEALAND.—Some important contracts are being placed in connection with the Auckland Electric Tramways Company, Limited, the construction contract for which has been secured by J. G. White & Co., Limited, of 22a College Hill, Cannon Street, London, E. C. The power house will be equipped with three generators of 300 kilowatts each, also switchboard and all accessories, manufactured by the General Electric Company. The generators will be direct connected to 475-hp horizontal cross compound condensing engines of British make. Cole, Marchens & Morley, Limited, having secured the contract. The rails—4000 tons—will be turned out by the Lorain Steel Company. Fifty motor equipments have been ordered of the General Electric Company. The boiler contract has, however, not yet been placed. The Auckland system, which will entail an initial expenditure not far short of $1,500,000, will be about 20 miles long. The greater portion of the road will be double track. The company will begin with 50 cars.

BRITISH THOMSON-HOUSTON CONTRACT.—The contract with the British Thomson-Houston Company for the equipment of the underground Great Northern & City Railway provides for 36 motor cars, each carrying two G. E. motors, with four third-rail collector shoes. Each train will consist of seven cars, three being motor, the two end and the middle. The generating plant will comprise four generators with switchboard apparatus, all of G. E. type, with four vertical cross compounds. Musgrave condensing engines, of 1250 ihp as normal load each. There will be two auxiliary generators, each 50 kilowatts. All the steam auxiliaries, etc., will be motor operated, and there will be a Hunt coal conveyor equal to 30 tons of coal per hour. This will be the first road in Great Britain to be operated entirely on the "train control system."

TROLLEY FREIGHT HANDLING.—The Milwaukee Common Council has passed an ordinance granting a franchise to the Milwaukee, Burlington & Lake Geneva Railroad to build an elevated road through the city. The road will be operated by electricity, and permits the running of freight trains over the streets. The franchise is perpetual. The route traverses the best part of the Kinnickinnic and Milwaukee River manufacturing districts. The company pays nothing for the franchise, except damages secured by abuting property-holders. The terminus of the road is at Michigan and Milwaukee Streets, in the heart of the East Side. Clarence Darrow, of Chicago, is one of the promoters. It is rumored that the Illinois Central or the Wisconsin Central is back of the project.

FIRST YANKEE PRODUCER GAS PLANT FOR SOUTH AMERICA.—The South American commission house of Agar Cross & Co., 11 Broadway, has just placed a contract for an American producer gas plant, which it is said is the first such order placed in this market for shipment to South America. The engine order, which calls for a 180-hp machine, has been allotted to Westinghouse, Church, Kerr & Co. The requisite producer will be manufactured by R. D. Wood & Co., of Philadelphia, Pa. The equipment is intended for operating an electric light plant in Buenos Ayres, Argentine Republic.

MR. GEORGE BULLOCK RETURNS FROM EUROPE.—Mr. George Bullock, president of the Bullock Electric Company, of Cincinnati, Ohio, who has been in England for the last two months, in connection with a proposition to build a plant on the other side for the purpose of manufacturing Bullock apparatus for the British and other European markets, returned last week to the United States. While nothing exactly definite has been decided upon, it may be said that negotiations are progressing satisfactorily for the establishment of works in the United Kingdom.

TO ENLARGE ALUMINUM PLANT.—The Pittsburg Reduction Company, which manufactures aluminum at works in New Kensington, Pa., and at Niagara Falls, N. Y., has let contracts that will practically double the capacity of the Niagara Falls works. The contract calls for a steel building with corrugated sheet covering, which has been placed with the McClintic-Marshall Construction Company, of Pittsburg. About 400 tons of structural iron are required, and the work is to be done by the middle of November.

SERRELL, WHITE & CIE., of Paris, have undertaken the establishment of a number of selling houses throughout France for the A. S. Cameron Steam Pump Works, of New York City. An order for a number of service pumps was received last week, this being the second order from the Marseilles district. The local branch of the above concern is Serrell & White at 18 Broadway, New York.

BIDS WANTED ON AUTOMOBILES.—B. H. Kroger, wholesale grocer, Cincinnati, Ohio, has asked for bids from builders of automobiles. He wants 30 vehicles, with a carrying capacity of from 1500 to 1800 lbs.

EXPORTS OF ELECTRICAL MATERIAL.—The following are the exports of electrical material from the port of New York for the week ended Aug. 28: Antwerp—68 packages electrical material, $3,659. Argentine Republic—19 packages electrical machinery, $2,002; 4 packages electrical material, $405. Aberdeen—1 package electrical machinery, $60. British Possessions in Africa—70 packages electrical material, $6,312; 23 packages electrical machinery, $4,000. British Australia—18 packages electrical machinery, $608; 498 packages electrical material, $131,668. British East Indies—3 packages electrical material, $250. Brazil—64 packages electrical material, $1,306. Bremen—4 generators, $1,080. British West Indies—68 packages electrical material, $1,606. Brussels—1 package electrical machinery, $45. Barcelona—64 packages electrical machinery, $2,619. Bilbao—1 case electrical material, $50. Cuba—8 packages electrical material, $91. Central America—11 packages electrical material, $170. Dutch Guiana—1 case electrical material, $13. British East Indies—17 cases electrical material, $300. Glasgow—26 packages electrical material, $1,647; 4 packages electrical machinery, $80. Havre—13 packages electrical machinery, $1,000; 19 packages of electrical machinery, $862. Hamburg—2 cases electrical material, $217; 56 cases electrical material, $2,617; 30 packages trolley poles, $1,000. Liecester—1 case electrical material, $131. Liverpool—43 packages electrical material, $5,243; 24 packages electrical material, $1,543. London—252 packages electrical machinery, $9,935; 81 cases electrical material, $4,166. Mexico—4 cases electrical material, $503; 13 cases electrical material, $322. Magdeburg—1 case electrical machinery, $45. Market Harbrough—3 cases electrical machinery, $250. New Zealand—12 cases electrical material, $200; 26 cases electrical material, $870. Newcastle—54 packages electrical material, $10,155. Peru—10 packages electrical material, $129. Rotterdam—2 cases electrical material, $50. Santo Domingo—19 cases electrical material, $533. Sheffield—1 case electrical machinery, $35. Southampton—44 cases electrical machinery, $6,326. Uruguay—16 packages electrical material, $435. Venezuela—1 case electrical material, $14. It is worthy of note that our best customers among our near neighbors on the South for electrical supplies are the Argentine Republic, Brazil and Mexico, all of whom are weekly importers. Of our patrons in the Eastern hemispere British Australia is at present our heaviest buyer, taking from us this week over $100,000 worth in one lot, while our English cousins still continue excellent weekly purchasers. The following are the exports of electrical material from the port of New York for the week ended Sept. 4: Antwerp—41 packages electrical material, $4,043. Alexandria—1 package electrical material, $40. Argentine Republic—193 cases electrical material, $10,403; 15 cases electrical machinery, $9,190. British Possessions in Africa—84 cases electrical material, $3,987; 1 case electrical machinery, $130. British East Indies—18 packages electrical material, $299; 3 packages electrical machinery, $150. Bremen—8 packages electrical material, $140. Berlin—6 cases electrical material, $294. British Guiana—8 cases electrical material, $75. British Australia—154 cases electrical material, $23,012; 21 cases electrical machinery, $2,193; 1 reel cable, $368. Brazil—25 packages electrical material, $1,700. British West Indies—3 cases electrical material, $1,700. Chili—7 cases electrical material, $153. Central America—21 cases electrical material, $858. Cuba—90 packages electrical material, $3,452. China—9 cases electrical material, $290. Cardiff—1 case electrical material, $135. Copenhagen—2 coils cable, $1,123. Genoa—22 cases electrical machinery, $3,000. Glasgow—420 cases electrical machinery, $52,310; 5 cases electrical material, $159. Hayti—1 case electrical material, $56. Hamburg—34 cases electrical material, $1,801. Hong Kong—28 cases electrical material, $728. Havre—14 packages electrical material, $1,258; 14 packages electrical machinery, $340. Japan—49 packages electrical material, $12,712. Liverpool—92 packages electrical material, $4,688; 18 packages electrical material, $981. Leeds—3 packages electrical material, $267. London—64 packages electrical machinery, $3,491; 110 packages electrical material, $4,456; 2 packages electrical machinery, $305. Mexico—91 packages electrical material, $3,138. Newfoundland—24 cases electrical material, $565. Nova Scotia—1 package electrical material, $40. Newcastle—3 cases electrical machinery, $582. Philippines—51 cases electrical material, $528. Rotterdam—2 cases electrical material, $100. Santander—3 cases electrical machinery, $258. Siam—2 cases electrical material, $208. U. S. Colombia—11 cases electrical material, $380. Vladivostock—10 cases electrical machinery, $2,355. Venezuela—374 cases electrical material, $1,695.

THE GREEN ENGINEERING COMPANY, Chicago, Ill., manufacturers of the well-known Green traveling link grates, report besides the sales of 12,000 horse-power to the Metropolitan Street Railway Company, Kansas City, which was the third order from this Company; sales to Cleveland City Railway Co.; Steubenville Traction Company; East St. Louis & Belleville Suburban Railway Company; Michigan Construction Company; B. J. Arnold Power Station Company; Danville Street Railway Company; Cudahy Packing Company; Anglo-American Provision Company; La Belle Iron Works; C. A. Pope & Co., Steubenville, Ohio; Lake Superior Power Company; Waukesha Sheet Steel Company, etc., etc. The officers of the company are P. Albert Poppenhusen, president, and Herman A. Poppenhusen, secretary and treasurer, while the office force and correspondence is in charge of Mr. J. William Helm, formerly secretary and treasurer of the North Chicago Street Railway Company, Chicago.

STORAGE BATTERY INSTALLATIONS.—Sipe & Sigler, of Cleveland, manufacturers of the Willard storage battery, are meeting with marked success in securing contracts for heavy installations, to which business they have recently commenced to cater. They have just closed a contract for a plant of 220 cells, 600 ampere-hours capacity, to be installed at St. Albans, Vt., for the New England Electric Railway Construction Company, and are making a complete installation of battery plant, booster and switchboard for the power plant at the United States Naval Academy, Annapolis. The battery will contain 140 cells, 2800 ampere-hour capacity. Sipe & Sigler are rushing work in order to complete the 4000 ampere-hour battery station being installed for the Cleveland Electric Railway Company. It is under forfeit to be completed in time for the heavy loads consequent upon the G. A. R. annual encampment to be held in that city this month.

THE MICA INSULATOR COMPANY announces that its selling agency in Europe, hitherto entrusted to Messrs. Bergtheil & Young, 12 Camomile Street, London, has ceased, and that an English company has been formed under the name The Mica Insulator Company, Limited, for the purpose of carrying on the European business. The principal office of the new company will be at its factory at Stansted, Essex. By uniting the selling department with the factory, the company believes that business will be facilitated by bringing it into closer touch with the market and enabling it to serve customers more promptly. The manufacture of the well and favorably known "Micanite," "Empire" insulating cloth and paper, and "M. I. C. Compound," of which this company is the inventor and originator, will be continued in America, as heretofore, by the Mica Insulator Company, with offices at 218 Water Street, New York, and 117 Lake Street, Chicago, and factories at Schenectady, N. Y.

HYDRAULIC PLANTS FOR BRAZIL AND PORTO RICO.—The Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, has obtained a contract from Rose & Knowles, San Paulo, Brazil, calling for a complete water power plant of 500 horse-power, which will be utilized for operating a cotton mill. A number of large compound condensing pumps have been ordered from the Stilwell-Bierce people for installation in the Central Aguirre, one of the most important sugar estates in Porto Rico. These pumps will have a capacity for handling 3000 gallons of water per minute. They are intended for irrigation purposes. The before-mentioned contracts were secured by Mr. George W. Neff, the New York manager of the Stilwell-Bierce & Smith-Vaile Company.

MACHINERY FOR SOUTH AMERICA.—Chief Engineer Pease, of the Buenos Ayres & Rosario Railway, is now here for the purpose of placing contracts for quantities of machine tools and electrical equipment to be installed in the new workshops of that road. He left this city Wednesday for Pittsburg, where he proposes to remain till the 19th inst., when he returns to New York. He intends to sail for South America Saturday, Sept. 21. While in this city Mr. Pease will stay at the Hoffman House. It is said that his purchases will aggregate a quarter of a million dollars.

GOULD STORAGE BATTERY COMPANY has recently closed a contract with Mr. George W. Vanderbilt for an equipment, and is now installing 64 cells of a normal 2000 ampere-hour capacity on his estate, Biltmore, North Carolina. The battery is for lighting and motor work, etc., and replaces one of older make put in some years ago.

BALL ENGINE CONTRACTS.—The Craddock-Terry shoe factory at Lynchburg, Va., will be equipped with electricity. The Ball Engine Company, Erie, Pa., furnishes the engine, which will be direct connected to a General Electric generator. The Billings Water Power Company, of Billings, Mont., has recently purchased a 250-hp engine from the Ball Engine Company.

THE RAWSON TELEPHONE COMPANY, of Elyria, Ohio, manufacturer of telephones, has decided to enlarge its plant. A third story will be added to the present building, and another building will be erected. The company is working on a large contract for telephones for an Albany, N. Y., exchange.

POWER FOR GREAT NORTHERN.—The Great Northern Railroad has decided to change the power of the shops at Hillyard from steam to electricity, the local water power company having contracted to furnish all the water power needed.

BULLOCK ELECTRIC CONTRACT.—The Bullock Electric Company, of Cincinnati, Ohio, has secured a contract for the supply of three 350-kw slow-speed generators to be installed for electric lighting purposes in the Mutual Life Building, New York City.

General News.

THE TELEPHONE.

DOVER, DEL.—The Indiana Long-Distance Telephone & Telegraph Company of Kentucky, with a capital stock of $1,000,000, was incorporated here. The company is authorized to construct and operate telegraph and telephone lines in Indiana, Ohio and Kentucky.

CAMILLA, GA.—The Camilla Telephone Company, recently incorporated, has a capital stock of $10,000, and will install a system starting with forty subscribers.

ATLANTA, GA.—The Standard Telephone Company will remodel and improve its entire plant, installing new machinery, etc., at a cost of $8,000.

SPRINGFIELD, ILL.—There is talk of an independent telephone system at Springfield.

CUSTER, ILL.—Dr. J. R. Allen has commenced putting up a telephone line between New City and Berry.

MORRISON, ILL.—The Whiteside County Telephone Company, capital stock $120,000, has been incorporated by Harry L. Hall, Walter W. Warner and Albert R. Baird.

ALTON, ILL.—The Board of Local Improvement at Upper Alton has decided to permit the Kinloch Telephone Company to enter the village by placing poles along Manning Street.

STERLING, ILL.—The City Council has granted a new twenty-year franchise to the Harrison Telephone Company, giving it the right to rebuild its lines and reconstruct its system in this city.

TAYLOR RIDGE, ILL.—The Farmers' Independent Trunk Telephone Association has been incorporated; capital stock, $2,500. Incorporators: Peter Eckhardt, W. H. Miller and A. A. Buffum.

CHICAGO, ILL.—Since the Banks and Burke telephone systems in Eminence township have been sold to a company, the citizens have decided to build their own lines independently of any company.

CHICAGO, ILL.—The Independent Telephone Company is pushing vigorously the work of installing its plant and announces that it will have 15,000 telephones in the downtown district by next spring.

CHICAGO, ILL.—A two-story addition is being made to the manufacturing plant at the southwest corner of Jackson Boulevard and Clinton Street for the Stromberg-Carlson Telephone Company, to cost $40,000.

MORRISON, ILL.—An ordinance requiring the Central Union Telephone Company to remove all its poles, wires and other property from the streets and alleys of the city of Peru, Ill., has been passed by the City Council of that city.

HARDIN, ILL.—At a stockholders' meeting a few days ago the Calhoun Telephone Company voted to increase its capital stock from $5,000 to $15,000. A proposition was also submitted to consolidate with the Pike County Telephone Company.

EDWARDSVILLE, ILL.—The Kinloch Telephone Company has secured admission to the county seat of Madison County. An ordinance has been passed granting it permission to install and operate a system. It provides for the carrying of wires in cables. The Central Union fought against granting the privilege.

BUSHNELL, ILL.—The Kurtz Telephone Company, which was recently granted a franchise at Macomb and intends to cover this part of the State with a network of wires, has commenced by purchasing the private line connecting Macomb and Colchester.

CHICAGO, ILL.—It is reported that the judges of the Circuit Court have been asked to assume jurisdiction over the affairs of the National Automatic Telephone Company. The petition was filed by Melvin E. Richardson, president of the company, and one of the creditors of the concern. The company, it is stated, is indebted to the amount of $13,000.

PLEASANT PLAIN, ILL.—The Boynton Telephone Company is constructing a line to Ashland and expects to connect several other towns before the winter sets in. The company has a station at New Berlin, at which point there are 25 local subscribers and 6 toll lines. At Pleasant Plains there are 25 local subscribers and 12 toll lines, and each of the two exchanges is equipped with a 100-drop cabinet board. The Swedish-American system is used.

TELL CITY, IND.—Manager John Backer will extend his telephone lines to Tell City soon.

ROSSVILLE, IND.—The Home Telephone Company, Rossville, has been incorporated; capital stock, $2,500.

INDIANAPOLIS, IND.—The Dubois County Telephone Company has increased its capital stock from $10,000 to $20,000.

WATERLOO, IND.—Manager Kelley of the local telephone exchange is preparing to extend the line southeast of Waterloo to Moore's Station.

MARION, IND.—The City Council has granted a franchise to the American Telephone & Telegraph Company, to place its poles and string its wires through the city.

LOGANSPORT, IND.—The Franklin City Council has declined to renew the Central Union telephone company's franchise, and has forbidden the company to place any more poles and dig any more holes in the streets. The marshal has been instructed to rigorously enforce the decree.

ELKHART, IND.—People of South Bend to the number of 500 have subscribed for service by the proposed new independent telephone company at that place. The Bell Company bought the other independent company's system about two years ago, and the citizens are now anxious to secure another competitor.

GREENSBURG, IND.—The New Independent Telephone Company, of this city, has increased its capital stock to $20,000 and is rapidly extending its lines throughout the county. Connections will soon be made with Milhousen, Newport and Westport. Considering that the company was organized but one year ago, the record is a good one.

WABASH, IND.—The Central Union Telephone Company has given notice to the people in this city and community that hereafter only telephones with long-distance transmitters will be put in, and that there will be no reduction in rates for long-distance service, which is now $3.50 and $2.50 a month. The rates for ordinary instruments are now $1 and $1.50 a month.

TIPTON, IND.—An enterprising postmaster at Tipton, Ind., has made a new use of the telephone which has proved successful. Each evening at 7 o'clock the farmers from all over the county put their receivers to their ears and hear the news of the day through their telephones. They are all connected by the Farmer's Telephone Company and the postmaster reads the news, beginning with the weather, then crop reports, etc. The day is at hand when all the farmers will be connected in this way and receive the news daily.

FRANKLIN, IND.—A motion has been filed in the United States Court to modify the injunction granted to the Central Union Telephone Company recently against this city to prevent the officials from removing the poles and wires and interfering with the company's property in any way until Oct. 1. The Central Union bought the plant and franchise of an older company and had begun to extend new lines when the city officials interfered by arresting the workmen. The city demands that all work cease until the matter is finally determined. The Council threatens to revoke the franchise.

INDIANAPOLIS, IND.—The Central Union Telephone Company boasts over an increase of 2000 subscribers since May 20. The company now has 6500 telephones in service. This large increase in so short a period has necessitated the enlargement of its switchboard capacity, and it is sparing neither labor nor expense in its efforts to furnish its patrons with a strictly first class service. It now has two switchboards on the way from New York. The new equipment will be installed at once. When this is done it can assure its patrons of a service superior to that ever furnished to the Indianapolis public.

GLEN HALL, IND.—The Odell Telephone Company has elected S. B. Lutz, president; H. G. Lutz, secretary and treasurer, and W. B. Foresman, manager. The company, whose incorporation was recently noted, purchased from the Receiver the Shawnee-Mound system, which has been in operation for six years. In one of the exchanges a Sterling board is used and in the other an American board, of 70 and 50 drops respectively. The line will be practically entirely reconstructed, and a toll line between Lafayette and Attica will be strung on the new poles. Most all of the company's subscribers, of which it has 187, are farmers.

INDIANAPOLIS, IND.—The Cumberland Telephone Company of Kentucky has filed articles of incorporation with the Secretary of State under the foreign corporation law. The capital stock is given in at $6,237,600; amount invested in Indiana, $201,732. The Indiana headquarters will be in Evansville. Under the same law the Central Union Telephone Company, with headquarters in Chicago, has filed articles of incorporation. The capital stock of the company is $6,963,000. The amount invested in Indiana is $1,740,750, and its Indiana representative is Walter Hill, of this city. The company paid the State a generous incorporation fee of $1,740.75.

BLUFFTON, IND.—The United Telephone Company, of Bluffton has consolidated its system with that of the independent companies at Hartford City on Sept. 7. This makes one of the largest telephone companies in the United States. The Bluffton Company turns into the pool 517 miles of toll lines, and the exchanges at Bluffton, Huntington, Portland and Geneva. The Hartford City Company puts into the pool the systems at Hartford City, Marion, Montpelier and Upland, and 210 miles of toll lines. The new organization will be known as the United Telephone Companies, and its headquarters will be in Bluffton. The capital stock has been increased from $100,000 to $300,000. The company claims to have 2,100 subscribers.

DUNCAN, IA.—There is being built a telephone trunk line from this town to Eliza.

WASHINGTON, IA.—The Union Dale Telephone Company, which has been organized at Riverside, has filed articles of incorporation. The capital stock is $3,000.

IONA CITY, IA.—The Uniondale Telephone Company has been incorporated. It is extending its line to the southwest and also to the north. It has about fifty or sixty patrons now, and is still growing.

DUBUQUE, IA.—The Tristate Telephone Company has filed articles of incorporation. The capital stock is $100,000. This is a Waukon institution, the men interested representing the Standard Telephone Company. The officers of the new company are: President, Vic H. Stevens; Vice-President, E. L. Cass; Secretary and Treasurer, C. H. Sandbeck. These, with Messrs. J. H. Denflhoff, J. W. Blessing and F. A. Irish, are directors, and also incorporators.

INDIAN TERRITORY.—Mr. Hummer, of Roff, president of the Arkansas Telephone Company, has received a permit from the Secretary of the Interior to build a line of telephone from Stroud, Oklahoma, to Sapulpa, Creek Nation, from Denison to Sapulpa, from South McAlester to Shawnee and from Hartshorne to Ardmore.

TOPEKA, KAN.—The McMahan Telephone Company is figuring on a line from Harveyville to Dover.

TOPEKA, KAN.—The Kansas & Missouri Telephone Company is erecting a new telephone line between Rossville and Willard.

LAKE CHARLES, LA.—The Louisiana & Texas Long-Distance Telephone Company is gradually making its way to Lake Charles and the west.

PERRY, LA.—A new telephone line has just been completed, running north from Linden to the old Greenvale post office. This line is seven miles long, with numerous branches.

WHITEFORD CENTRE, MICH.—There is talk of extending the telephone to Gert.

MIDLAND, MICH.—The Union Telephone Company is taking steps to establish an exchange here.

DETROIT, MICH.—The Wyandotte Council has granted a 30-year franchise to the People's Telephone Company.

GREENVILLE, MICH.—The Independent telephone exchange at Greenville will pass into the hands of the Citizens' Telephone Company, of this city, Oct. 1.

DETROIT, MICH.—The permit for the People's Telephone Company's new building was taken out by Architect Louis Kamper and the construction of the masonry has been commenced.

GRAND RAPIDS, MICH.—The Michigan Telephone Company has discontinued work on its "south" and "west" branch exchanges, and it is doubtful if work will be taken up again by fall. The reason assigned to the suspension of work is that its central exchange is entirely adequate to handle its present number of subscribers.

DETROIT, MICH.—It is stated that the People's Telephone Company of Detroit will soon absorb the Oakland County Telephone Company. If the plan is carried out all of the places of any importance in the State excepting Ann Arbor, Ypsilanti, Mt. Clemens and possibly one or two other cities will be connected with independent toll lines.

JACKSON, MICH.—Articles of incorporation of the People's Telephone Company have been filed; capital stock, $149,500. Incorporators: J. C. Richardson, George W. Carter, George A. Matthews, Thomas M. Smith, M. F. Cottrell, W. H. Maloney, Z. C. Eldred, all of Jackson, and Arthur Pack, of Orchard Lake, and Joseph B. Ware, of Detroit.

SAGINAW, MICH.—The Valley Telephone Company has nearly finished its new lines in Huron County. The copper circuit is now in operation from Saginaw to Bay Port and will be finished to Bad Axe within a week. The company has leased the old Stebbins line, which will add to the service Port Hope, Redman, Soule, Clark's Siding and Crown.

WELLS, MINN.—The Western Electric Telephone Company is extending its telephone line from Bricelyn through Frost and Marna to Blue Earth.

WINONA, MINN.—The Winona Telephone Company completed its line from Witoka to Pickwick, and will have it in operation to La Moille.

MINNEAPOLIS, MINN.—The Western Electric Telephone Company has finished its line between here and Mitchell. The workmen went to Kimball to put in a line from that place to Ganp Valley.

CASS LAKE, MINN.—An agreement has been entered into between the Cass Lake Water, Light & Power Company, owners of a telephone franchise granted by the village Council of Cass Lake and the Iron Range Electric Telephone Company whereby a telephone exchange will be put in here.

MINNEAPOLIS, MINN.—The newly-organized Consolidated Telephone & Telegraph Company will be associated with the Twin City Telephone Company, and will have its headquarters in the latter's new exchange which is being erected at Third Avenue South and Seventh Street. The company will have a working capital of $100,000. The officers and directors are: E. H. Moulton, president; Clarence H. Judson, secretary; Edward E. Webster, treasurer; H. H. Potter and F. R. Clement. In Duluth the Consolidated Company will connect with the Zenith City Telephone Company, having between 1500 and 1600 subscribers, and in West Superior the connection will be with the People's Telephone Company, which has 800 subscribers. The Zenith City Company has been making great progress in Duluth.

BOONVILLE, MO.—An independent telephone line is being built from Lamine to Chouteau Springs in Cooper County.

KANSAS CITY, MO.—An independent telephone system will probably be established in Warrensburg in the near future by McDonald Bros., of Pleasant Hill.

NEVADA, MO.—The Nevada & Monticello telephone line is completed and in operation. It will be extended to Stockton, thence to Lamar, to connect there with the zinc belt of southwest Missouri.

ST. LOUIS, MO.—The Kinloch Telephone Company has taken possession of its new quarters in the Haagen building. The exchange is located on the third floor, and the local offices of the company will adjoin the exchange.

WARRENSBURG, MO.—The Independent Telephone Company, of Windsor, has applied for a franchise in this city. The Twentieth Century Telephone Company, of Pleasant Hill has been here for several weeks endeavoring to secure a franchise. The companies will endeavor to oust the Bell company's local system if admitted.

PLEASANT HILL, MO.—The Twentieth Century Telephone Company of the United States of America, with office in this place, has been incorporated, with a capital stock of $10,000. The incorporators are B. T. McDonald, H. B. Howell, J. M. McDonald and others.

DURHAM, N. C.—R. S. Plummer, recently appointed manager of the local Bell telephone exchange, will take charge Sept. 1. It is announced that the Bell telephone exchange will be rebuilt. Long-distance connections with New York and other points is expected to be made about Sept. 15.

DAVENPORT, N. D., wants a telephone system.

GRAND FORKS, N. D.—Langdon's new telephone line has fifty telephones in use and applications for thirty more.

ALBION, NEB.—The Farmers' Telephone Company, of Scribner, will soon have its line in operation.

OMAHA, NEB.—The Nebraska Telephone Company has completed the construction of a line to Sarpy Mills Park.

SALEM, N. J.—The City Council has passed an ordinance granting the Interstate Telephone Company a franchise providing it furnish the city with six telephones free, and pay $1,000 for the franchise.

ELIZABETH, N. J.—The Elizabeth Telephone Company, which was organized six years ago, has been sold to Barker Gummere, of Trenton, and J. L. Hammell, president of the Trenton Trust Company, who, it is understood, are interested in the Interstate Telephone Company.

SILVER CITY, N. M.—It is stated that the long-distance telephone line between this city, Deming and El Paso will be commenced in the near future.

BUFFALO, N. Y.—The Home Telephone Company, of this city, has been granted a franchise to erect a line in Niagara Falls, Ont.

ALBANY, N. Y.—The Watkins Telephone Company has been incorporated to operate in Watkins and Montour Falls; capital, $25,000. Directors: J. H. Fuller, K. F. Gill and Charles B. Stowe, of Cleveland, Ohio.

FREMONT, OHIO.—The Fremont Home Telephone Company now has over 600 telephones in operation.

WAYNESFIELD, OHIO.—The Auglaize Telephone Company has been incorporated with a capital stock of $5,000.

MAUMEE, OHIO.—A franchise has been granted to the Home Telephone Company of Toledo to establish an exchange in Maumee.

FREMONT, OHIO.—The Fremont Home Telephone Company will install a branch exchange at Lindsey, connecting it with Fremont.

BELLEFONTAINE, OHIO.—The Bellefontaine Telephone Company has secured the franchise for an independent telephone line through Zanesfield.

CHAGRIN FALLS, OHIO.—The Central Union Telephone Company has again failed, after several attempts, to secure a franchise in Chagrin Falls.

COLUMBUS, OHIO.—During the State Fair the Columbus Citizen's Telephone Company operated a completely equipped branch exchange on the fair grounds.

FT. RECOVERY, OHIO.—The Home Telephone Company, of Ft. Recovery, Ohio, has been incorporated, with $10,000 capital, by local people to build an exchange.

TOLEDO, OHIO.—Charles Sumner and Frank W. Wachter went to Sylvania and secured a franchise from the village council for an independent telephone lines.

OXFORD, OHIO.—Ezra Bourne has made a proposition to buy out the Oxford telephone exchange. The Bell Company made a similar proposition, but it has been rejected.

WAPAKONETA, OHIO.—The Wapakoneta Telephone Company has just completed the installation of an up-to-date telephone system, replacing the old one, at a cost of over $15,000.

BOARDMAN, OHIO.—The Youngstown Telephone Company has opened a branch exchange at Boardman, giving free connection with Youngstown, Canfield, Lowellville, Greenford and New Buffalo.

BELLEVUE, OHIO.—The Flat Rock Telephone Company, heretofore a partnership, has been organized as a stock company. Improvements will be made and lines to Colby and Fireside will be built.

CHICAGO JUNCTION, OHIO.—The Huron County Telephone Company now has 275 telephones in operation in Chicago Junction, 25 new subscribers having been added to the list in the past month.

CLYDE, OHIO.—The Clyde Telephone Company has increased its capital stock from $10,000 to $40,000, and improvements will be made. The company is rapidly covering the farming section in this vicinity.

SALEM, OHIO.—Work of rebuilding has been started on the independent exchange at Toronto, Jefferson County. The subscription list has increased from 15 to 150 since W. F. Crossley obtained control.

MANSFIELD, OHIO.—The Mansfield Telephone Company is making connections very rapidly, and the exchange, which will supply 1200 subscribers in Mansfield and vicinity, will soon be ready for operation.

COLUMBUS, OHIO.—The United States Telephone Company (long-distance) has large forces of men at work on a through trunk line from Columbus to Richmond, Ind., connecting Dayton, Springfield, Eaton and other towns.

ASHTABULA, OHIO.—The Ashtabula Telephone Company is receiving bids for the construction of a new exchange building and will also install a new central energy system plant. The exchange is to be in operation within 90 days.

MASSILLON, OHIO.—The United States Telephone Company has completed two long-distance lines connecting Cleveland and Massillon, and a third is now being built. Lines are being built from Massillon to Canal Fulton and Richville.

LANCASTER, OHIO.—C. T. Moore, superintendent of the Lancaster Telephone Company, has been made manager of the independent plant at Logan, Ohio, which has recently been absorbed by the Federal Telephone Company, of Cleveland.

CINCINNATI, OHIO.—The Cincinnati Telephone corporation is extending its subway system on Walnut Hills and has asked of the Board of Public Service permits to open up several downtown streets and to erect distributing poles in various parts of the city.

TOLEDO, OHIO.—The Home Telephone Company's request for permission to build underground conduits has been granted by the city engineer, and operations have commenced. The telephone company has been granted permission to build a conduit in Seneca Street from Cherry to Walnut Street.

WAPAKONETA, OHIO.—A temporary injunction has been granted against W. H. Fledderjohann and R. F. Coppess, of New Knoxville, Ohio, at the instance of J. Maiseh & Company, who claim to have bought the former's telephone franchise here. The former firm was preparing to build an exchange in Wapakoneta.

SYLVANIA, OHIO.—The Sylvania Home Telephone Company of Lucas County has been incorporated, with $10,000 capital, to build an independent exchange. Incorporators: Frank W. Wacher, F. F. Graves, Henry M. Barfield and Charles E. Sumner. The same people are interested in the new exchange being built at Toledo.

CLEVELAND, OHIO.—The two local telephone companies have been asked by Mayor Johnson to submit propositions for laying cables and placing telephones in the three water works cribs, which have recently been the scene of a series of accidents. In one case loss of life might have been averted had the men been able to communicate with the shore.

CIRCLEVILLE, OHIO.—The new exchange of the Circleville Home Telephone Company will be placed in operation within a few days with about 400 subscribers. The company expects to cover the whole of Pickaway County with farmers' and toll lines with branch exchanges in the smaller towns. Exchanges are being installed at Ashville and Williamsport.

HAMILTON, OHIO.—The City & Suburban Telephone Company (Bell) has brought suit to restrain the Hamilton, Hughes & Monroe, and the Western Butler Telephone companies from erecting poles and stringing wires through Hamilton, on the ground that it is in violation of franchises and the city ordinances. The companies mentioned propose to give independent long-distance service through Hamilton.

PORTSMOUTH, OHIO.—In less than one year the Portsmouth Telephone Company has increased its subscription list from 500 to 750, which is 300 more than the Bell Company ever had. The company is preparing to build a number of rural lines and expects to cover the whole of Scioto County. The demand for farmers' telephones is increasing faster than it can be taken care of. F. B. Finney is president of the Portsmouth Telephone Company.

CLEVELAND, OHIO.—The United States Telephone Company, which operates the long-distance wires in Ohio and Michigan, and portions of Indiana and Pennsylvania, has completed arrangements to connect with the lines now being built in Kentucky by the New Long-Distance Telephone Company, of Kentucky. This company was incorporated recently with $1,000,000 capital stock, and it proposes to connect up all the independent exchanges in that State and vicinity. The new connection, when built, will give the United States system connection with the Southern States.

CLEVELAND, OHIO.—The Consolidated Telephone Company, which was recently organized in this city to develop the independent telephone movement in New York State, has made several announcements as to the personnel of its business management. Richard Bacon, a well known Cleveland attorney, has been appointed general counsel of the company, and will have charge of its legal matters. He will have his headquarters at the company's general offices in the Electric Building, Cleveland. Mr. E. Bingham Allen has been appointed general right of way agent for the Inter-Ocean Telephone Company, the New York long-distance company.

FORT GIBSON, OKLA.—The Council has granted a franchise to Stapler & Hicks, of Tahlequah, to erect and maintain a telephone system in Fort Gibson for twenty years, 5 per cent of the proceeds to go to the town.

GUTHRIE, OKLA.—A charter has been granted to the Kiowa & Comanche Telephone Company, which will have a local exchange at Lawton and toll lines through the new country, connecting with all other independent lines. The incorporators are Daniel Rinehart, of Horton, Kan.; H. C. Cash, A. W. McKeand, E. G. Muliken and A. H. Cobbs.

BAKER CITY, ORE.—The Pacific Coast Telephone & Telegraph Company will build a telephone line from Baker City to Cornucopia.

ASTORIA, ORE.—The City Council passed an ordinance granting a 35-year franchise to the Pacific Coast Telephone & Telegraph Company.

BAKER CITY, ORE.—The Express Telephone & Telegraph Company, of Express, has been incorporated. The officers and stockholders are: W. E. Ayers, president; F. L. Shaw, vice-president; F. S. Bubb, secretary and treasurer. This is a local telephone line connecting with the various settlements in the vicinity of Express.

ASTORIA, ORE.—The City Council has finally reached an agreement with the Pacific States Telephone & Telegraph Company in the matter of a license. Under the new arrangement the franchise of the company is extended 35 years longer, or until 1937. The company is required to pay $500 to the city immediately, and, commencing with January, 1902, $250 yearly thereafter for 15 years. After 15 years, $400 must be paid yearly until the franchise expires. The arrangement will net the city $10,250.

LAMBERTVILLE, PA.—A direct telephone line has been established between Stockton and Sergeantville.

PHILADELPHIA, PA.—The Keystone Telephone Company has been granted permission by the Rockledge Council to lay its wires in that borough.

NEWTOWN, PA.—The Standard Telephone Company, which has constructed a line from this place to Bristol, will extend its service to Burlington, N. J.

DOYLESTOWN, PA.—The Standard Telephone Company, which has constructed a line through a section of Bucks County, will extend its service to Burlington, N. J.

CHESTER, PA.—The Independent Telegraph & Telephone Company of Delaware County will ask Chester City Councils for the privilege of putting its wires underground.

WEST CHESTER, PA.—The Delaware and Atlantic Telegraph & Telephone Company has made arrangements with the Southern Telephone & Telegraph Company to connect with Lancaster via Quarryville.

WILKESBARRE, PA.—J. B. Russell & Company, local bankers, are the fiscal agents of the new Illinois Telephone & Telegraph Company, of Chicago, capitalized at $5,000,000. The investors are all Luzerne and Lackawanna County capitalists.

PITTSBURG, PA.—The Union Telephone & Messenger Company, of East Pittsburg, Pa., has been chartered, with a capital stock of $1200. The company has organized, with the following-named gentlemen on the Board of Directors: F. R. Cyphers, James P. Kelly, Archie Graham, John S. Stewart and D. R. Fose.

PITTSBURG, PA.—The stockholders of the West Penn Telephone Company of Washington, Pa., have increased the capital stock of the company from $12,000 to $50,000. With the additional financial resources the company expects to gain entrance into the town of Washington, a right which has hitherto been denied.

PARKSTON, S. D., is talking of a local telephone system.

ARTESIAN, S. D.—The people of Artesian have decided to put in a local telephone system which it is expected will be in operation by Oct. 15.

MITCHELL, S. D.—C. E. Wisard, of Howard, has been awarded the contract for furnishing the material for the local telephone system to be established at Bridgewater.

PIERRE, S. D.—A project is under way for the construction of a telephone line from this city to the Black Hills.

NASHVILLE, TENN.—The Tennessee River Telephone Company, of Meigs County, has increased its capital from $3,000 to $10,000.

FRANKLIN, TENN.—The organization of a local telephone company is said to be under consideration. Local and Pennsylvania capital are said to be interested.

KNOXVILLE, TENN.—The Cumberland Telephone Company has commenced the construction of a toll line from Jellico, Tenn., to Richwood, Ky., a distance of sixty-five miles. At Jellico the line connects with the toll line into Knoxville. At Richwood connections will be made with Louisville and Cincinnati.

HEMPSTEAD, TEX.—C. A. Horton, of Austin, has contracted to construct a telephone system from Hempstead to Prairie View College.

EMORY, TEX.—The Emory Telephone Company, capital stock $1,000, has been incorporated by W. D. Peeples, A. H. Rhodes, T. R. Potts and others.

GREENVILLE, TEX.—J. T. Young, J. G. Gordon and Messrs. Thompson, of Cooper, have been granted a franchise for an independent telephone company in this city.

STAUNTON, VA.—The Long-Distance Telephone Company of Virginia contemplates the extension of its lines.

RICHMOND, VA.—The Peninsula Telephone & Telegraph Company has been chartered, to operate a line in York and Elizabeth City counties, Va., connecting with the Hampton exchange.

WILLIAMSBURG, VA.—The Peninsula Telephone & Telegraph Company will probably extend its line up the Peninsula to Richmond. There are already two telephone lines in this section, and the advent upon the scene of a third one has created no little surprise. It is said work on the new line will begin as soon as the right of way has been secured.

SEATTLE, WASH.—By a recent change in the management of the Automatic Telephone Exchange Company of Seattle, Wash., General Manager E. A. Seeley and General Superintendent G. G. Hunt have been relieved of their positions and W. S. Claypool, who recently arrived from the East, has assumed the local management. It is understood the company will soon reorganize under the franchise of the Independent Telephone Company and drop the present name. Messrs. Seeley and Hunt will retain a financial interest in the company, but will engage in other business in another State.

BARBADOES, W. I.—There are 600 miles of telephone lines in this island. The system is operated by a private company.

LEETOWN, W. VA.—The Winchester Telephone Company will soon extend the line from Leetown to Middleway in Jefferson County.

HARPER, WIS., is to have a telephone exchange.

WAUKESHA, WIS.—A. L. Hutchinson, of Weyauwega, Wis., will, in the interest of the Independent telephone combination, ask this city for a franchise to build a telephone exchange.

APOLLONIA, WIS.—The Chippewa Valley Telephone Company has completed its Atlanta, Bruce and Baldwinsville lines to this place, and a local and central exchange will now be installed.

LADYSMITH, WIS.—The stringing of the wires of the Chippewa Valley Telephone Company from Barron to this place has been completed, and work will now be started on the local exchange in this city.

LA CROSSE, WIS.—The Bell Telephone Company has taken down its line between Houston and Money Creek, Minn. It has not been abandoned permanently, and as soon as it is possible will be rebuilt.

KENOSHA, WIS.—An ordinance is being drawn up to cause the telephone wires to be placed underground. In order to anticipate the demands of the city the telephone company has cabled many of its wires.

OREGON, WIS.—W. H. Jones, W. A. Soden, J. M. O'Brien, J. Barry and W. I. Ames, of this city, have organized and filed articles of association for a telephone company to build an exchange in this city. The capital stock is $5,000.

MADISON, WIS.—The Chippewa Valley Telephone Company, of Bruce, recently incorporated, has organized and is officered as follows: T. W. Borum, president; A. L. Arpin, vice-president; A. Hein, secretary, and O. E. Pederson, treasurer. The exchange was started on Sept. 1 with 100 subscribers, using Stromberg-Carlson apparatus. The company has 60 miles of toll line, and contemplates extending to Prentice Point and to Rhinelander.

MENOMINEE, WIS.—The Green Bay & Lake Michigan Telephone Company has been organized, with ex-Governor Edward Scofield, of Oconto, Wis., and A. L. Hutchinson, of Weyauwega, Wis., at the head. The company has applied for franchises in Escanaba, Menominee, Marinette, Oconto, Green Bay, Sheboygan and Manitowoc. It will build toll lines connecting with the independent system of the company. E. T. Munger, of Havana, Ill., president of the Havana Telephone Company, has been engaged as superintendent. The new company will offer house telephones at $1 per month and office instruments for $2.

MARSHFIELD, WIS.—Within a very short time Marshfield will have long-distance telephone connections. The differences between the local telephone company and the Wisconsin Telephone Company have finally been amicably adjusted. The points of difference which have prevented an earlier adjustment have been conceded by the Wisconsin company agreeing to connect with the local line and come into the city on the poles of the latter, the business to be in charge of the operator of the local company, for which service they agree to pay 15 per cent on long-distance business. They also agree not to operate a local exchange.

MILWAUKEE, WIS.—The Independent Consolidated Telephone Company has been organized, and articles of incorporation filed. The capital stock is $500,000. Officers were elected as follows: President, Ed. T. Fairchild, of Milwaukee; Vice-President, F. T. Boesel, Milwaukee; Secretary, A. H. Low, of La Crosse, and H. S. Hadfield, of Milwaukee, treasurer. These, together with A. L. Hutchinson, of Weyauwega, form the board of directors. They are also the principal stockholders, but W. W. Townsend and F. H. Lord, of Chicago;

E. T. Monger, of Green Bay; E. W. Keyser, of Waukesha; L. W. Burch and J. C. Harper, of Madison; R. Valentine, of Janesville and C. W. Switzer, of La Crosse are more or less interested. The company will co-operate with the independent companies throughout the State. It has already secured options on a greater portion of the independent lines, amounting to probably 600 miles of toll lines, with some 1200 subscribers. The systems brought together will be greatly improved in equipment, etc.

ELECTRIC LIGHT AND POWER.

SAN FRANCISCO, CALIF.—At the Union shaft of the Sierra Nevada, Union Consolidated and Mexican mines on the Comstock, the installation of the new electric hoist plant is nearly completed, and it will soon be in operation.

SAN FRANCISCO, CALIF.—It is again reported that there is a probability of a sale of the Mutual Electric Light Company's plant in San Francisco to the People's Gas & Electric Company, on a basis of about $12 a share, which would make the purchase price nearly $500,000. It is said that the would-be purchasers wish to use the plant to force the San Francisco Gas & Electric Company to sell out also.

MONTREAL, CAN.—The Royal Electric Company, which is now merged in the new electrical combination of Montreal, the Montreal Heat, Light & Power Company, has secured a renewal of the contract for the lighting of the city of Montreal. At a special meeting of the City Council a motion was carried offering the Royal Company the contract for a term of five years at $60 per lamp. This figure is $35 less than the company's tender and $6 more than the tender of the St. Lawrence Power Company, which was the lowest tenderer.

HARTFORD, CONN.—The property of the Hartford Light & Power Company, having passed into the hands of the Hartford Electric Light Company, the first-named company will cease to be a corporation after Oct. 1. The outstanding obligations of the Hartford Light & Power Company at the time of the arrangement made with the Hartford Electric Light Company consisted of its capital stock, a first mortgage of $150,000, a second mortgage of $60,000, and claims against the company amounting to $644.80. This indebtedness has all been taken care of except the first and second mortgages. The price paid for the stock was $10 a share.

DOVER, DEL.—An amendment was sent here from Baltimore, Md., to the certificate of incorporation of the Standard Light, Heat & Power Company, of Washington, filed here some months ago, with a capital stock of $200,000, increasing the same to $1,000,000. The incorporators of the concern are Robert S. Lawrence, Edward A. Oldham, E. Hume Talbot and Frank J. Stillman, of Washington, D. C., and Jems Virdin, Dover.

JONESBORO, IND.—The Jonesboro Electric Lighting Company has incorporated, with a capital stock of $20,000. A new and modern plant will be installed at once.

WINDFALL, IND.—The town trustees have approved the estimates for an electric light and water works plant, and will advertise for bids to construct the plant at an early day.

INDIANAPOLIS, IND.—The People's Electric Light & Heating Company of Bloomfield has filed notice with the Secretary of State of an increase of capital from $35,000 to $150,000.

LAPORTE, IND.—The Laporte County Electric Company, with a capital stock of $160,000, has filed articles of incorporation. The company proposes to furnish light, power and heat to Laporte and Michigan City.

INDIANAPOLIS, IND.—Under the foreign incorporation act articles of incorporation were filed by the General Gas, Electric & Power Company, the principal office of which is in New Jersey, with a capital stock of $75,000. The property in this State is at Connersville, and is valued at $40,000.

BALTIMORE, MD.—The Fidelity & Deposit Company, of Maryland, as trustee and commissioner, will sell the Catawba Electric Power Company of North Carolina at public auction at Dallas, N. C., on Sept. 11.

MINNEAPOLIS, MINN.—The Pipestone Electric Light, Heat & Power Company, has filed amended articles of incorporation, fixing its capital stock at $50,000.

BROOKFIELD, MO.—The electric light plant, which has been able to run only a few hours each evening for the past two weeks, was compelled to shut down entirely on account of the lack of water. It will remain closed until it rains.

LEBANON, OHIO.—The Council of Lebanon has decided to issue bonds to the amount of $6,000 to increase the capacity of the municipal electric lighting plant.

WARREN, OHIO.—The Warren Electric Light & Power Company has elected officers as follows: Directors—B. C. Geiger, Chas. Fillis, S. A. Corbin, D. R. Dodson, H. B. Weir, J. N. Green and C. D. Backus; President, R. D. Dodson; Secretary-Treasurer, C. D. Backus.

SANDUSKY, OHIO.—The Sandusky Gas & Electric Light Company is preparing to enlarge its power station, and has placed a contract with the Warren Electric Manufacturing Company, of Sandusky, for a large alternating current generator. Other machinery will be purchased. The lighting company has a contract to illuminate the city after Jan. 1.

CINCINNATI, OHIO.—The contract for the motor cars to be used in the operation of the new system of canal transportation by the Miami & Erie Transportation Company has been awarded the Cleveland Construction Company. The cars will be equipped with 150-hp motors and will be powerful enough to draw ten heavily laden canal boats at a speed of ten miles an hour. This speed may not be maintained, however, because the State charter stipulates a uniform speed of not to exceed four miles an hour. The cars will be 7 feet 10 inches long. The road will be standard gauge, rails 75 pounds to the yard. Eighteen of the cars will be built at once. Contracts for two cars of a smaller pattern are to be awarded also. These cars are to be used to draw the boats under bridges in Cincinnati which are too low to permit passage of the larger cars. The Edison plant in Cincinnati will furnish the power, and fourteen substations will be installed along the line.

OKLAHOMA CITY, OKLA.—Contracts have been made for the installation of a $15,000 storage battery plant in the Oklahoma City Electric Light & Power Company's plant.

CORNWALL, ONT.—The town Council is considering the question of pumping the water supply of the town by electricity.

PITTSBURG, PA.—Two hundred organized electrical workers and wiremen of Pittsburg and Allegheny threatened to go on a strike last week unless the contractors grant them an advance in wages. At a conference a compromise was effected. The contractors promised to advance the wages 50 cents a day two months from now.

PITTSBURG, PA.—The Morgantown Electric Light & Power Company, of Morgantown, W. Va., has sold its plant and franchise for $14,000 to a syndicate composed of I. C. White, S. D. Hirschman, Frank Cox, W. E. Glasscock, Joseph H. McDermott and R. E. Fast. The plant will be enlarged and an electric railroad is contemplated.

THE ELECTRIC RAILWAY.

ENSLEY, ALA.—The Steel Cities Railway Company has been incorporated at Ensley; capital $500,000. It is proposed to build a local electric railway, to be extended to Bessemer and Brookside. J. W. Minor, of Ensley, is president

SAN FRANCISCO, CALIF.—It is reported that the Market Street railway lines in this city are to be sold to an Eastern syndicate backed by the Widener-Elkins-Whitney interests.

MONTREAL, CAN.—The Montreal Street Railway Company is making extensive alterations to its power house on William Street. Two big 1600-hp engines and dynamos are now being installed there.

GAINESVILLE, GA.—The Gainesville & Dahlonega Electric Railway Company has purchased the Dunlap water power, which embraces 750 acres of land, for $20,000. A dam will be constructed at the shoals of such height as will furnish fall enough to generate 5000 horse-power. Seven hundred and fifty thousand dollars' worth of bonds have been issued and the company will begin work not later than Oct. 1.

WAUKEGAN, ILL.—The survey for a double-track electric railway connecting the Chicago and Milwaukee electric railway at Lake Bluff with the St. Paul railroad depot at Libertyville is completed and the projectors expect to build the line unless something arises to prevent their securing the right of way.

LA PORTE, IND.—The County Commissioners have granted to the Chicago, Valparaiso & Michigan City Railway Company a franchise for 50 years.

KOKOMO, IND.—A new company was recently organized in this city to build an interurban railway line from here to Peru. The men composing the company are Allen Shewman and Dr. Henry Holmes, of Greenbay, Wis.

INDIANAPOLIS, IND.—According to a statement given out by the Secretary of the State Tax Board, there are 513.38 miles of electric railway in Indiana, valued for taxation at $6,696,210; the rolling stock at $774,412, and improvements and right of way at $275,830, making a total valuation of State taxation of $7,746,452. Each county in addition taxes the value of the companies' personal and real property, which amounts to a million or more dollars.

LEAVENWORTH, KAN.—The Kansas City-Leavenworth Electric Railway Company contemplates building an electric line from Leavenworth to Atchison, Kan., and St. Joseph, Mo., with a branch to Platte City, Mo., and another line from Leavenworth to Topeka.

MONTICELLO, KY.—J. C. Slayback, of Hamilton, Ohio, and T. F. McClure, of Cincinnati, are interested in a proposed electric railway from Monticello to Burnside or Sommerset.

BALTIMORE, MD.—The Liberty Turnpike Electric Railroad Company has been incorporated. The directors of the company are Messrs. Frank H. Callaway, James F. Ingram, Jr., Milton W. Offutt, Fielder C. Slingluff and John W. Styne. The capital stock is fixed at $150,000.

MARYLAND.—At a meeting in Baltimore of the Havre de Grace Railway & Power Company, it has been decided to begin immediately the construction of the line, which will be 16 miles in length. Capital and right of way to a sufficient amount have been secured. The line will connect the towns of Belair and Havre de Grace. At the former it will be able to convey passengers to and from the Maryland & Pennsylvania Railroad, and at the latter it will reach the Baltimore & Ohio and Pennsylvania roads.

UPTON, MASS.—The Selectmen of Upton have voted to grant a franchise to the Milford & Upton Electric Railway Company.

SPRINGFIELD, MASS.—A company has been organized under the name of the Ludlow & Holyoke Street Railway Company to build an electric road from Ludlow to Chicopee. The officers are: President, John E. Stevens, Ludlow; Clerk and Treasurer, George A. Birnie, Ludlow.

KALAMAZOO, MICH.—The proposed electric railway between here and Grand Rapids has been purchased by the Bishop syndicate, of Ohio, which intends putting in a system costing about $1,250,000. The system will take in the towns of Plainwell, Otsego and Martin, as well as numerous small villages on the route.

ST. PAUL, MINN.—The Chicago Great Western, it is stated, contemplates the installation of electric power for all its suburban service out of St. Paul, reaching as far south as Randolph, 30 miles. Edward C. Boynton, of the engineering department, it is said has been engaged in making estimates.

NATCHEZ, MISS.—The Natchez electric street railway is now assured. The necessary amount of bonds has been subscribed and the contract for the work will be closed in a few days. The company will build about four miles of track. The track and equipment will cost $50,000.

TRENTON, N. J.—The Trenton Street Railway Company still keeps up its fight to prevent the Tom Johnson line, which proposes to run cars from Philadelphia to New York, from getting into Trenton by way of the Calhoun Street bridge. It has begun condemnation proceedings in the name of the Mercer

Traction Company, organized under the General Railway law and so having the power to condemn land, to secure the strategic strip of land which now belongs to a son of Mr. Johnson.

ALBANY, N. Y.—A certificate of change of name of the Colonial City Traction Company, of Kingston to the Kingston Consolidated Railroad Company, has been filed with the Secretary of State.

SYRACUSE, N. Y.—The State Railroad Commission has granted the application of the Syracuse, Skaneateles & Moravia Railway Company for a charter to build an electric railway from Moravia, in the southern part of Cayuga County, to Syracuse.

ROCHESTER, N. Y.—Application for a certificate authorizing the construction of the Monroe County Electric Belt Line Railroad has been filed in the office of the State Railroad Commission. The road will connect Rochester with Penfield, Dispatch, Fairport and Pittsford.

ALBANY, N. Y.—The Ontario & Wayne Traction Company has been incorporated, with a capital of $500,000. The directors are: Senator John Raines, William L. Parkhurst, J. L. Burnett, Walter H. Knapp and J. H. Pardee, of Canandaigua; B. H. Davis, F. W. Griffith, of Palmyra; J. M. Stoddard, of Shortsville, and L. S. Cuyler, of Pultneyville.

ALBANY, N. Y.—The New York & Port Chester Railroad Company has filed with the Secretary of State an amended certificate of incorporation to construct an electric railroad from Willis Avenue, Borough of the Bronx, New York City, through Mt. Vernon, Pelham, New Rochelle, Larchmont, Mamaroneck, Rye and Port Chester, a distance of about 25 miles. The company has a capital of $250,000.

CANASTOTA, N. Y.—The Canastota & Morrisville Railway Company has been incorporated to construct an electric street surface road fifteen miles long, in Madison County, connecting Canastota and Morrisville, N. Y. The capital is $200,000. The directors are Leander W. Burroughs, John Reidy, John A. Johnson, John H. Broad and Brownell Tompkins, of Morrisville; William H. Patten, Milton DeLano, and John B. Weaver, of Canastota, and W. Emmet Coe, of Peterboro.

ALBANY, N. Y.—A joint agreement of consolidation between the Glens Falls, Sandy Hill & Fort Edward Street Railway Company; Warren County Railway; Stillwater & Mechanicsville Street Railway Company, Greenwich & Schuylerville Electric Railway; Saratoga Traction Company, and Saratoga Northern Railway has been filed with the Secretary of State. The capital stock of these companies is $2,600,000. The name of the new company is Hudson Valley Railway Company. The principal office is at Waterford, N. Y., which is the southern terminal of the above system of electric railroads, heretofore known as the Powers-Colvin system.

NORTHPORT, L. I.—The Northport Traction Company has been incorporated, to build and operate a street surface electric road three miles long, between East Northport station, on the Long Island Railroad, in Suffolk County, and Northport Harbor. The capital stock is $50,000, divided into 500 shares of $100 each. The directors for the first year are: William H. Baldwin, Jr., William F. Brown and William J. Kelly, of Brooklyn; Frank E. Haff, of Long Island City; John Wolf Hillman, Edward Pidgeon and Edward Thompson, of Northport; William F. Potter, of Flushing, and F. C. Scudder, of Babylon. The company's principal office is to be in Northport.

OSSINING, N. Y.—Receiver John V. Cockcroft has sold the Ossining Electric Railroad Company to Barnet & Henderson, of Cleveland, Ohio, who represent a syndicate. The price paid was $50,000. The line will be carried eastward to Pleasantville, and from there to Port Chester, via White Plains. Southward it will go as far as Kingsbridge. From Ossining it is proposed to go northward to Croton and Croton Dam, and from the latter place to Golden's Bridge, on the Harlem Railroad, where connections will be made with a new line in course of construction in Connecticut. The new line will run an extension from Croton to Ver Planck's Point to connect with the Peekskill Electric Railroad.

COLUMBUS, OHIO.—There is a field for an electric railway between Kenton and Wapakoneta, in this State.

COLUMBUS, OHIO.—The Galion & Crestline Traction Company has been incorporated; capital stock, $110,000.

CANTON, OHIO.—The Canton-Akron Railway Company is securing right of way for its proposed extension to New Philadelphia.

TIFFIN, OHIO.—The Seneca County Commissioners have granted a franchise through the county to the Tiffin & Port Clinton Railway Company.

DAYTON, OHIO.—G. M. Hodges, of this place, is promoting a road to be known as the Cincinnati, Hamilton, Richmond & Muncie Traction Company.

CINCINNATI, OHIO.—The Rapid Railway Company, which is promoted by G. R. Scrugham and others of this city has applied for a franchise in Hamilton County.

COLUMBUS, OHIO.—The Franklin County Commissioners have granted a 25-year franchise over the Granville Pike to the Columbus, Newark & Eastern Traction Company.

BUCYRUS, OHIO.—The Buckeye Traction Company, which proposes to build a road from Bucyrus to Norwalk, has been granted a franchise through town by the Bucyrus Council.

MARIETTA, OHIO.—The Washington County Traction Company has been incorporated by local people to build a line from Marietta to Newport, a distance of 15 miles. The capital is $250,000.

TOLEDO, OHIO.—The Toledo & Lima Traction Company has been incorporated, with $50,000 capital stock, by J. D. S. Neeley, D. J. Cable, A. K. Detwiler, H. A. Tobey and G. G. Metzgar.

TOLEDO, OHIO.—C. A. Thatcher, of Toledo, has secured franchises for street railway lines in Petoskey, Mich., and an interurban line connecting with Harbor Springs and a number of small towns.

TOLEDO, OHIO.—The villages of Bellmore and Weston have granted franchises to the Toledo, Columbus, Springfield & Cincinnati Railway Company, which proposes to build a road across the State.

XENIA, OHIO.—Hon. John P. Martin, of Xenia, has secured franchises for a system of electric railways in Florida, involving an expenditure of $2,500,000. A. . Abbott, of Chicago, is engineer for the project.

CLEVELAND, OHIO.—Franchises and right of way for a road projected by A. D. Prosser to extend from Grand Rapids to Kalamazoo, Mich., have been purchased by George T. Bishop and others of this city.

COLUMBUS, OHIO.—The Conneaut & Southeastern Railway Company of incorporated, with $10,000 capital stock, by George C. Chapman, Clifford W. Smith, George H. Cleveland, C. M. Brown and G. W. Watson.

CLEVELAND, OHIO.—The Cuyahoga County Commissioners have granted a 25-year franchise to Daniel Gindelsperger, Fred. Green and others for a second line from Cleveland to Akron by way of Brecksville and Richfield.

CLYDE, OHIO.—The Sandusky, Clyde, Tiffin & Southern Railway will be built over a private right of way just outside the corporation line in Clyde. All right of way for the road has been secured and surveys are being made.

LIMA, OHIO.—Stockholders of the Lima, Lewison & Bellefontaine Railway Company have agreed to the terms of a plan for merging the property into the newly organized Toledo, Columbus, Springfield & Cincinnati Railway Company.

COLUMBUS, OHIO.—The Conneaut & Southeastern Railway Company of Conneaut, capital $10,000, has been incorporated. The incorporators are: George J. Chapman, Clifford W. Smith, George B. Watson, George H. Cleveland and G. M. Brown.

NORWALK, OHIO.—The Norwalk Council has granted a franchise into town to the Cleveland, Elyria & Western Railway Company. A franchise for the Sandusky & Interurban Company is being held up because the company declines to give universal transfers.

CLEVELAND, OHIO.—R. L. Andrews, general manager of the newly consolidated Cleveland & Eastern Railway, is making plans to greatly improve the Chagrin Falls & Eastern line, which is being extended to form the through line to Warren and Youngstown.

NEW BERLIN, OHIO.—L. E. Meyers, president of the Canton-Akron Railway Company, states that the company will build at this point a mammoth lighting and power plant, sufficient to supply light in Canton, Akron and surrounding towns and to furnish power for the road.

COLUMBUS, OHIO.—The Columbus, Marion, Tiffin & Toledo Electric Railway Company has been incorporated, with a capital of $20,000. S. E. Barlow, G. W. Kemp, C. E. Sawyer, H. B. Hane and Senator W. S. Harding are the incorporators. Marion will be the headquarters.

CLEVELAND, OHIO.—The Cleveland & Southern Railway Company has filed a mortgage for $1,000,000 given to the Cleveland Trust Company to secure funds with which to prosecute the work of building the road. The mortgage is for 20 years and will bear interest at 5 per cent.

CLEVELAND. OHIO.—F. H. Ginn and George T. Bishop, of Cleveland, are promoting a line which will extend from Kalamazoo, Mich., to Grand Rapids, with a branch to Otsego. The company will be known as the Southern Michigan Traction Company, and E. P. Roberts & Company, of Cleveland, are preparing estimates on the project.

COLUMBUS, OHIO.—The Toledo, Columbus, Springfield & Cincinnati Railway Company, whose incorporation was recently noted in these columns, is at work on the construction plans. Seven miles of the road are now under construction. Power will be furnished temporarily by the Western Ohio Company from St. Mary's. The company will be in the market for equipment and supplies.

CLEVELAND, OHIO.—The latest move of the Everett-Moore syndicate is the securing control of several lines on the Canadian side of the Detroit River. The roads are the Windsor, Sandwich & Walkerville Electric Railway, the South Essex Railway and the Windsor City Railway Company. The properties include about 15 miles in operation and several under construction, and it is said that the combined roads are valued at about $500,000. It is stated that the power-house of the Detroit system will be enlarged to take care of the entire system on both sides of the river.

TOLEDO, OHIO.—The stockholders of the Toledo, Columbus, Springfield & Cincinnati Railway Company organized in this city last week as follows: Directors, Wm. P. Heston, Claud Wyant and S. C. Heston, Toledo; C. H. Wells, Milwaukee; Ellis Bartholomew, Youngstown; I. N. Covault, Sidney; X. H. Holler, Lima; E. M. Hamilton, Bellefontaine, and Hon. A. F. McCormick, Columbus. Officers: Ellis Bartholomew, president; C. H. Wells, first vice-president; A. F. McCormick, second vice-president; I. N. Covault, secretary; Wm. P. Heston, treasurer; Claud Wyant, general counsel.

CLEVELAND, OHIO.—An important move on the plans of the Everett-Moore syndicate which will be announced shortly, will be the consolidation of all the traction properties in Michigan now owned by the syndicate, into one company, to be incorporated under the laws of that State. It will include the city lines of the Detroit United Railways and the interurban lines radiating from Detroit which have been purchased or are held under option by the syndicate. Mr. Everett is quoted as saying that the Michigan corporation will have a capital stock of $12,500,000 and bonds to the amount of $30,000,000, this amount being necessary to cover all the outstanding securities of the various companies.

OTTAWA, ONT.—The deal by which a syndicate of Montreal capitalists have secured the amalgamation of the Pontiac & Pacific Junction Railway, the Hull Electric Railway and the Interprovincial bridge, which spans the river between Ottawa and Hull, at figures aggregating some $5,000,000, is one of the largest railway deals which has taken place in Canada for some years. The three railways and the bridge will, in future, be under one management under the name of the Ottawa, Northern & Western Railway Company. The purchase price of the Hull Electric Railway was $1,000,000.

CARLISLE, PA.—The City Council has granted a franchise to the Baltimore, Westminster & Gettysburg Street Railway Company. The company will lay more than 100 miles of track.

WASHINGTON, PA.—The Washington Electric Street Railway Company will build a trolley line from the terminus of the present line at Tylerday

through the new industrial section west of town, through West Washington and connect with the main line in Washington.

HARRISBURG, PA.—A syndicate, of which L. H. Mathews, of Pittsburg, is president, has secured charters for the following companies: The Canonsburg & Washington Street Railway Company, to build a line eight miles long; capital, $48,000. The West Washington Street Railway Company, to build a line three miles long; capital, $18,000. The North Washington & Meadow Lands Street Railway Company, to build a line six miles long; capital, $36,000. East Washington Street Railway Company, to build a line four miles long; capital, $24,000. The Washington & Oak Grove Street Railway Company, to run through Washington; capital, $18,000.

PHILADELPHIA, PA.—A despatch received here from Nebraska states that plans are under way for the consolidation of a number of street railway lines in four cities in that State, and the operation of the combined system with the energy derived from a water-power plant. It it stated that the plans involve an outlay of $20,000,000, and the project is backed by J. Pierpont Morgan. According to the report, the railway interests in Omaha, South Omaha and Freemont, Neb., and Council Bluffs, Ia., are to be amalgamated. The second object of the enterprise is the establishing of a power plant at a point four miles south of Freemont. The dam, it is stated, will itself cost $3,500,000, and it is calculated that there will be a fall of water of 157 feet. Engineers estimate that 30,000 horse-power will be available for 24 hours a day, or 50,000 horse-power for ten hours a day. The power will be used for the operation of the consolidated railway systems and for electric lighting in the four cities named, besides its distribution among manufacturing plants.

PROVIDENCE, R. I.—The United Traction & Electric Company, of New York and Providence, announces the purchase of the branch steam road connecting Attleboro and North Attleboro, now operated by the New York, New Haven & Hartford Railroad Company.

COLUMBIA, S. C.—South Carolinans are going in for long electric railways. Recently the building of a line from Aiken to Augusta was begun, and now the Secretary of State has chartered the Greenville-Piedmont Traction Company, with a minimum capital of $100,000, that may be increased to $250,000. This company will construct a line from Greenville to Piedmont, a distance of twelve miles. Pennsylvania capitalists are interested. A plan is on foot to extend the Buffalo road, running from Union, about eight miles, to Buffalo mills, via White Rock Lithia Springs and Glenn Springs, connecting at White Rock with an extension of the Spartanburg electric line, giving an electric road between Union and Spartanburg.

CHATTANOOGA, TENN.—The Gadsden and Attalia car line, operating between this place and Gadsden, has been sold by Colonel R. B. Kyle, of Gadsden, to Messrs. W. H. Weller and C. D. Ward, of Gadsden.

SAN ANTONIO, TEX.—Permission having been granted the San Antonio Traction Company to consolidate with the West Side Street Railway line, the Traction Company has taken formal possession.

SALT LAKE, UTAH.—The street railway systems of Salt Lake City were recently merged into one corporation. At directors' meetings the property of the Salt Lake City and of the Rapid Transit companies was transferred to the Consolidated Railway & Power Company, which is capitalized at $4,000,000. The new company includes as well several smaller companies previously absorbed.

KEWAUNEE, WIS.—The city has granted the Northwestern Interurban Electric Railway Company a 35-year franchise.

MILWAUKEE, WIS.—The Northwestern Interurban Electric Railway Company has been incorporated, with a nominal capital of $25,000. The incorporators are C. A. McGee, H. F. Cochems, W. Y. Scanlan and B. Eaton, of Milwaukee.

OSHKOSH, WIS.—Manager E. E. Downs, of the traction company, confirms the sale of the Oshkosh city electric line, of 17 miles, and the Oshkosh-Neenah interurban, of 13 miles, by Emerson, McMillin & Company, of New York, to an Eastern syndicate, of Boston, headed by F. S. Donnell. The purchase means the building of the Oshkosh-Fond du Lac line, of 20 miles, and the Oshkosh-Omro-Berlin line, of 24 miles.

LEGAL.

"ONCE A CONTRACT ALWAYS A CONTRACT."—Judge Wallace, of Newcastle, Pa., has just handed down a decision in a case in equity between the Newcastle Electric Company and the city of Newcastle, which may be of great interest to every corporation selling electric current. It appears that five years ago the city of Newcastle entered into a contract with the Newcastle Electric Company for lighting the streets. This contract the city now wishes to rescind, and hence the suit. In his decision the judge says that when the city entered into a contract five years ago with the electric company to light the streets, the municipality waived all rights it might hold to build a plant of its own or give the contract to another company. In other words, the judge holds that once a contract always a contract, the only matter to be agreed upon being the price.

STORAGE BATTERY LITIGATION.—Richard Siegman, of New York, who began suit a few days ago in the Court of Chancery against the directors of the Electric Vehicle Company, has instituted a similar proceeding against the directors of the Electric Storage Battery Company. Mr. Siegman alleges that the directors of the two companies entered into a conspiracy to divert from the Vehicle Company into the treasury of the Battery Company certain of the assets and stock of the Vehicle Company. He charges that this was done to enrich the directors at the expense of the stockholders of the Vehicle Company. His bill of complaint narrates the various complicated transactions in Columbia Automobile, Electric Vehicle and Electric Storage Battery plants and stocks which took place last year.

EJECTMENT SUIT.—A great legal battle has commenced at Sault Ste. Marie, by the St. Mary's Power Company filing a suit in ejectment against the Chandler-Dunbar Water Power Company and the Edison Sault Electric Company, for a half interest in certain private land claims. The suit is a sequel to the recent organization of the St. Mary's Power Company, which is capitalized at $100,000, with $50,000 paid in. The incorporators and stockholders are Francis H. Clergue, Bertrand J. Clergue, Ernest V. Clergue, Sault Ste. Marie, Ont.; Edward V. Douglas, Walter P. Douglas, Frank S. Lewis, Philadelphia, Pa.; William B. Cady, Detroit, Mich. The pieces of land in contention are situated at the head of the falls, and have been held by the Chandler-Dunbar people under purchase and tax title for about ten years. The Chandler-Dunbar holdings are considered to be worth anywhere from $750,000 to $1,000,000 in prospective value.

FORGERY BY TELEGRAPH.—The United States Circuit Court of Appeals, in the Northern District of California, has held the Pacific Postal Telegraph Cable Company liable for the sum of $840, which one of its operators in San Francisco secured from the Bank of Palo Alto by means of a false telegram, which the operator forged in the name of the Farmers & Merchants' Bank of San Francisco. The operator, while employed in the company's office at San Francisco, conspired with another man to defraud the Palo Alto bank. He forged and sent a telegram to that bank, and transmitted it himself over the wires to the operator at Palo Alto, requesting the bank to pay $840 to Harry L. Cator, "without identification." The bank paid the money to the other man, who impersonated Cator. It does not appear that there was any such person as Cator. The bank sued the telegraph company, and the latter tried to evade responsibility on the ground that the act was one which was not within the scope of the operator's authority and was entirely unauthorized. The company was held liable, however, on the ground that the act was within the apparent scope of the operator's employment; and where one of two innocent parties must suffer the loss must fall on the one who made the injury possible.

PERSONAL.

MR. JOSEPH LAWRENCE, president of the Edison Ore Milling Syndicate, is now on a visit to the United States.

GENERAL JOHN I. SABIN, president of the Chicago and Central Union Telephone Companies, sailed on the Deutschland last week for Europe.

MR. R. H. BEACH, manager of the Railway Department of the General Electric Company, returned last week from a four weeks' tour in Mexico.

PROF. R. B. OWENS, of the department of electrical engineering at McGill University, Montreal, has been in the United States lately visiting friends, etc.

MR. G. MARCONI has been presented in London by the Marquis Di Loreto, in behalf of the Italian Foreign Office, with the gold medal of the Italian Science Society.

MR. FREDERICK WENDELL HUME, formerly connected with the Western Electric Company, of Chicago, has accepted a position with the Electric Storage Battery Company, of Philadelphia.

MR. H. D. HUBBARD, who is private secretary to President Harper, of Chicago University, has been appointed secretary of the new National Bureau of Standard created by Congress this year.

MESSRS. F. SARGENT and L. A. Ferguson, who have been making a trip together through England and Europe, have returned home after making a very complete study of recent electrical work there.

MR. R. W. PALMER, the inventor of the ingenious electrograph, has been in New York lately promoting the interests of the corporation formed in Cleveland to push the device, the Electrograph Company of America.

MR. G. W. CHANCE, chief engineer of the Tagona Water & Light Company, has complete charge of the Lake Superior Power Company's electric installations at the "Soo," and has in hand the building of the street railways there.

PROF. CHAS. R. STURDEVANT has resigned as professor of electrical engineering at the State College of Kentucky, at Lexington, and has become associated with the consulting firm of E. P. Roberts & Company, of Cleveland.

MR. C. T. MALCOLMSON, mechanical and electrical engineer of the Charleston, S. C., Exposition, has been in New York arranging for the plant for that show, and will shortly start installation. He will visit Buffalo this week to study electrical conditions at the Pan-American.

PROF. W. S. ALDRICH has now been appointed to the directorship of the Thomas S. Clarkson School of Technology, Potsdam, N. Y., where he may be counted upon to do good work. The entrance requirements are those of the regents of the University of New York. The school has been thoroughly provided for in the appointment of new instructors, additional equipment and reorganization of courses. There are four-year engineering courses in theoretical and practical work leading to degrees of batchelor of science in civil, electrical and mechanical engineering.

MR. CHARLES A. PRATT, of Chicago, who for the past five years has been in business as a consulting electrical engineer, has announced the formation of a co-partnership with Mr. Charles G. Atkins. This step is the natural result of Mr. Pratt's expanding business which necessitated increased facilities to handle the work. He has secured in Mr. Atkins a man of ability and wide experience, and one who is well and favorably known in Chicago engineering circles. The new firm of Pratt & Atkins will conduct a general engineering business in electrical, steam and mechanical lines.

MR. W. S. BARSTOW, until recently chief engineer of the Brooklyn Edison Company, has now opened offices as a consulting electrical engineer at the Bowling Green Building, New York City. Mr. Barstow will give special attention to central station and power plant work, for which an active experience of some fourteen years eminently qualifies him, the engineering apon which he has been engaged ranking with the heaviest and most progressive in this country. Mr. Barstow is a graduate of Columbia University, was in the Edison Machine Works at Schenectady from 1887 and 1889, and was associated with the Brooklyn Edison Company from 1889 until this summer. His references include Messrs. C. A. Coffin, T. A. Edison, F. B. Crocker, E. M. Shepard, A. W. Brady, Spencer Trask Company, J. D. Fairchild, president of the Kings County Trust Company; G. H. Southard, president of the Franklin Trust Company, and L.

M. Palmer. In short, this accomplished and public-spirited young engineer carries with him into his new work the good wishes and support of a host of influential friends.

MR. C. W. MORSE.—The well known newspaper correspondent "Holland," in the Philadelphia *Press* says, relative to C. W. Morse, who offers $2,000,000 in cash for control of the Telephone, Telegraph & Cable Company of America, that he gained his first notoriety through his association with the Ice Trust. He was not then conspicuously identified with New York banking interests, although he was associated with the Garfield Bank, through which Mayor Van Wyck negotiated the loan as alleged by which he secured a large block of Ice Trust stock. Within a few months, however, Mr. Morse was discovered to have become perhaps the largest individual owner in banking stock in New York City. He bought all he could get of the stock of the National City Bank, paying a very high price for it. He also secured the control of the Bank of New Amsterdam and following that bought a majority of the stock of another bank and changed its name. Then he was discovered to have secured practically the control of the Nineteenth Ward Bank and he went on buying bank stock until he was a large owner in twelve banks or trust corporations and the owner of a majority of stocks of some of them. Mr. Morse is one of the wealthiest men in New York and it has been the presumption that it was his purpose ultimately to become a master capitalist operating through the many financial institutions wherein his interest gave him command of vast resources.

BUFFALO PERSONALS.—Following is a list of recent callers at the booth of the ELECTRICAL WORLD AND ENGINEER in Electricity Building, Pan-American Exposition: C. J. Bogue, New York, N. Y.; Wm. M. Porter, Elwood, Ind.; P. J. Kruesi, New York, N. Y.; D. R. Clayton, Athens, Ohio; Samuel B. Zerfou, Harrisburg, Pa.; G. E. Cornisch, Oswego, N. Y.; Walter J. Garside, London, Ont.; Walter Gummey, Depew, N. Y.; O. W. Visscher, Holland, Mich.; J. S. McBride, Pittsburg, Pa.; J. M. Howard, Ogdensburg, N. Y.; E. Bracken, St. Catherines, Ont.; J. T. Freeman, Rochester, N. Y.; F. J. Skinner, Boston, Mass.; G. Wiebe, Halstead, Kan.; Henry Watts, Buffalo, N. Y.; F. J. Carlton, Toledo, Ohio; Claude E. H. Law, Solina, Ont.; Willis L. Towne, Amherst, Mass.; A. J. Nixon, Richmond, Ohio; T. J. Vanar, Detroit, Mich.; C. N. Smith, Cleveland, Ohio; J. C. Stut, San Francisco, Calif.; Ralph A. Garrison, Albany, N. Y.; C. W. Squire, Bloomfield, N. J.; T. Defor, Bay City, Mich.; Alfred I. Brown, Cincinnati, Ohio; I. F. Shepard, Cincinnati, Ohio; J. D. Kieley, Brooklyn, N. Y.; F. E. McNall, Medina, N. Y.; Geo. H. Harris, Birmingham, Ala.; A. H. Ford, Buffalo, N. Y.; Edward Durant, New York, N. Y.; Arthur H. Potts, London, Eng.; M. Dings, Milwaukee, Wis.; F. A. Williams, New York, N. Y.; Alex. F. Ormsbee, Brooklyn, N. Y.; C. H. Tyndall, Mt. Vernon, N. Y.; W. N. Smith, New York, N. Y.; W. S. Bennett, New York, N. Y.; E. F. Morrill, Brooklyn, N. Y.; E. H. Couwbe, London, Eng.; Geo. E. Holton, Catasauqua, Pa.; A. E. Payne, Montreal, Can.; R. L. Bruce, Pittsburg, Pa.; A. H. Mitchell, Thayers Corners, N. Y.; Thos. H. Capener, Cleveland, Ohio; D. B. Long, Buffalo, N. Y.; Geo. R. Smith, Solsville, N. Y.; W. A. Davis, Buffalo, N. Y.; Arthur Hull, Cayuga, Ont.

Trade Notes.

THE BURT MANUFACTURING COMPANY, of Akron, Ohio, has recently installed a Cross oil filter in the power plant of the Washington monument.

THE ELECTRIC APPLIANCE COMPANY has just placed upon the market a new cabinet type of wall telephone for both series and bridging work. Special descriptive matter is being sent upon application.

BECK ELECTRIC COMPANY, St. Louis, Mo., has moved to larger quarters in that city, at 10 North Twelfth Street, where it will carry a larger and more complete stock than ever of electrical supplies, which can be drawn on by mail or telephone.

CHAPMAN VOLTAGE REGULATORS.—Mr. W. H. Chapman, of Portland, Me., informs us that his voltage regulators will hereafter be manufactured exclusively by the Portland Company, which is said to be the largest manufacturing concern in the city, dating back to 1846.

THE STUART-HOWLAND COMPANY, Boston, has recently sent out a circular letter to the trade, announcing the fact that it has added to its list of travelling salesmen Mr. A. McNab Little, formerly of the Western Electric Company. He will represent the Stuart-Howland Company in New York and Northern Pennsylvania.

J. J. REIDY & CO., New Haven, Conn., have added new machinery to their plant for manufacturing climbers. The Manhattan Electrical Supply Company, Chicago; McIntosh-Huntington Company, Cleveland, and W. B. Belknap, Louisville, carry a very large stock of these Donnelly climbers and can supply small dealers from stock at factory prices.

CINCINNATI PLANER COMPANY.—The new addition to the plant of the Cincinnati, Ohio, Planer Company, having been completed, the company is now putting in the equipment of machine tools, which includes several planers of its own make, a 36-inch automatic gear cutter, a universal grinding machine, a horizontal boring and drilling machine, a radial drill, a large special turret machine, a milling machine, and several engine lathes.

THE CENTRAL ELECTRIC COMPANY, of Chicago, has published a new discount sheet on its general catalogue dated Sept. 1, which has been distributed to the general trade. Any one having a Central Electric Company general catalogue who has not received a discount sheet should notify the company, and a copy will be sent by return mail. This discount sheet not only covers everything listed in its general catalogue, but contains much new material which has been placed on the market since the publication of the same.

WOTTON ELECTRIC MANUFACTURING COMPANY, Atlanta, Ga., contemplates enlarging its plant very extensively in the next month or two. Mr. G. F. Schoen, the secretary, reports that the company's extension bell is meeting with a great demand all over the country. It is particularly well adapted to noisy places where the ordinary extension bell on telephone lines cannot be heard, and is also well adapted for use at railway crossings for signaling purposes. The concern is making, in addition, a specialty of dental apparatus and is turning out a very unique outfit in the way of a surgical transformer for cautery work.

RAILROAD CAR LIGHTING EQUIPMENT.—The Gould Coupler Company, of Depew, N. Y., whose local offices are at 18-20 West Thirty-fourth Street, New York, reports a number of sales of its railroad car electric lighting equipments. The Royal train of the Canadian Pacific Railway, which will convey the Duke and Duchess of York and Cornwall through Canada, will be furnished with the Gould system of electric lighting. There will be seven cars, lighted with 960 candle-power each. The Governor-General of Canada's new car, built by Barney & Smith, is to have an 800-cp equipment. A similar equipment has also been ordered for the car of the Governor of New South Wales, and three Pullman cars recently built for use by President Diaz, of Mexico, will also have lighting equipments of 800 candle-power each. Domestic Gould orders include equipments for 14 dining cars on the New York Central and a number for the Wabash Railroad.

ASBESTOS INSULATION.—The H. W. Johns Manufacturing Company reports the following recent contracts: William Cramp & Sons Ship & Engine Building Company, Philadelphia, for work on the battleship "Maine," installing asbestos non-splinterable bulkhead insulation; Mackay residence, Roslyn, L. I., using fire felt sectional covering; all the covering at the Hahne Building, Newark, N. J., using fire felt, asbestocel, anti-sweat and homogenous brine, sectional covering, also fire felt blocks and cement; State Normal School, Fredonia, N. Y., using nonburn, fire felt sectional covering; New York State Custodial Asylum, Newark, N. Y., non-burn and fire felt covering; Strathmore apartments, 52d Street and Seventh Avenue, asbestocel covering; Connecticut State Prison, using asbestocel covering and asbestocel sheets, finished with cement; Youngstown, Ohio, Consolidated Gas & Electric Company, using 1½-inch fire felt sectional, and also 1½-inch asbestos cement; Fazenweather Building, New Haven, Yale College, fire felt and cement felting; Newark Free Library, Newark, N. J., using fire felt and cement felting; Scoville Manufacturing Company, Waterbury, Conn., covering for new insulation of engines, H. W. Johns Manufacturing Company's materials used.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED SEPT. 3, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

681,692. ELECTRIC INCANDESCENT LAMP; P. A. Gibbins, New York, N. Y. App. filed Feb. 18, 1899. Renewed Jan. 16, 1901. (See Current News and Notes.)

681,694. TUBE WELDING MACHINE; W. S. Gorton, Cleveland, Ohio. App. filed Jan. 26, 1901. Relates to the supporting mandrils and the construction of the electrical contacts.

681,696. APPARATUS FOR HAULING ELECTRIC CABLES; H. B. Grinnell, New York, N. Y. App. filed Nov. 30, 1900. A wheeled vehicle having hauling sheaves and means for driving the same whereby cables can be readily drawn through subway conduits.

681,712. MEANS FOR CONTROLLING ELECTRIC CURRENTS; P. Kennedy, Brooklyn, N. Y. App. filed March 26, 1898. Various features of an automatic controller.

681,716. ELECTRIC CIRCUIT CONTROLLER; H. W. Leonard, New York, N. Y. App. filed March 27, 1899. The rheostat arm rubs heavily against the final contact.

681,724. TELEPHONE EXCHANGE SYSTEM; J. L. McQuarrie, Chicago, Ill. App. filed Nov. 10, 1898. Means for automatically conveying intelligence between the operators as to the condition of the various devices employed in establishing and severing connections.

681,725. ELECTRICAL FLUSH RECEPTACLE AND PLUG; W. J, Newton, New York, N. Y. App. filed Oct. 10, 1899. Details.

681,730. ELECTRIC PIANO PLAYER; T. B. Powers, New York, N. Y. App. filed July 11, 1900. An armature of the magnet connected with the key, rotates, and by means of a crank connection this rotation depresses the key.

681,739. ELECTRIC IGNITER; F. A. Ruff, Detroit, Mich. App. filed Dec. 3, 1900. Details.

681,742. CONNECTION COUNTER FOR TELEPHONE LINES; C. E. Scribner, Chicago, Ill. App. filed Nov. 22, 1897. Details.

681,743. SWITCHBOARD FOR TELEPHONE LINES; C. E. Scribner, Chicago, Ill. App. filed Dec. 26, 1899. Automatic appliances for preventing impulses of current in the lines, arising from accidental contact between parts of the plugs and jacks.

681,744. TELEPHONE CALL BELL; C. E. Scribner, Chicago, Ill. App. filed Jan. 20, 1900. The bell magnet is wound so that it will ring with either a continuous or an alternating current.

681,754. SAFETY DEVICE FOR AUTOMATIC ELECTRIC GAS LIGHTING APPARATUS; H. C. Thomson, Boston, Mass. App. filed Aug. 6, 1900. Details.

681,757. INSULATOR; H. Traun, Hamburg, Germany. App. filed Dec. 7, 1900. A metallic frame provided with a cross-bar extending from one side to the other, the whole being entirely covered by a layer of vulcanite.

681,763. ART OF DEVELOPING STATIC ELECTRICITY; R. V. Wagner, Chicago, Ill. App. filed March 7, 1901. The method of developing electrical energy, which consists in rotating a non-conducting body continuously in one direction in proximity to an inducer continuously charged with energy of one polarity only, inducing on a rotating surface a development of electrical energy on one polarity only, and collecting the electricity so developed.

681,768. REGULATING AND CONTROLLING ELECTRICAL TRANSLATING DEVICES; Granville T. Woods, of New York. App. filed Jan. 14, 1895. The working motor is regulated by means of a second motor or other suitable induction apparatus placed in series with the armature so as to set up a regulating e. m. f. in the circuit, means being provided whereby this e. m. f. can be varied at will.

681,776. ELECTRIC SWITCH; W. F. Bossert, Utica, N. Y. App. filed May 20, 1901. A spring is located at the pivot of the switch arm to help release it from the clips.

681,779. ELECTRIC CLOCK; O. A. En Holm, Pleasantville, N. Y. App. filed Oct. 1, 1900. The driving weight of the clock is of magnetic material and surrounded by a solenoid coil which raises it after a certain movement downward.

681,780. SIGNAL FOR ELECTRIC RAILROADS; H. T. Gibbs, Portsmouth, R. I. App. filed Feb. 28, 1901. The signals are set by means of certain selective devices.

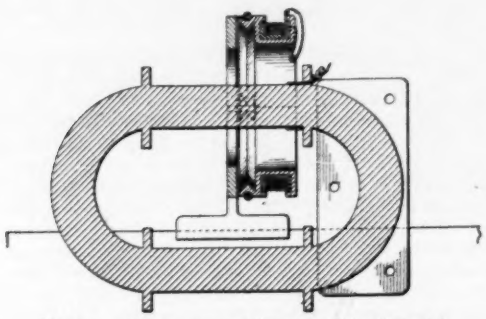
681,800. STATIONARY ARMATURE AND INDUCTOR; O. Lasche, Berlin, Germany. App. filed June 18, 1901. Sheet metal rings and segments for stationary armatures and inducer rings of electrical machines, provided with one or more pressure exerting devices at or near those points where deformation is greatest, for the purpose of obviating the inward and outward bending of the rings or segments.

681,812. SUPPORT FOR TELEPHONE APPARATUS; E. E. Ries, New York, N. Y. App. filed Sept. 19, 1898. A telescoping arm carrying the mouthpiece.

681,813. SUPPORT FOR TELEPHONE TRANSMITTERS OR OTHER APPARATUS; E. E. Ries, New York, N. Y. App. filed Sept. 10, 1898. An extensible arm for the telephone, made up of groups of sliding rods insulated from each other and having sliding contacts to carry the current.

681,835. MEANS FOR BRAKING ELECTRICITY METERS; F. Saldaña, Paris, France. App. filed May 22, 1900. (See Current News and Notes.)

681,860. SERVICE METER FOR TELEPHONE EXCHANGES; C. E. Scribner, Chicago, Ill. App. filed Jan. 12, 1901. A signal is automatically operated to show that the meter has properly registered.



682,142.—Means for Coiling Flexible Material.

681,868. CONNECTING PLUG FOR TELEGRAPH SWITCHBOARDS; J. A. Bowen, Millvale, Pa. App. filed Dec. 8, 1900. The plugs are so constructed that when necessary a second plug can be inserted into the first to obtain a different connection, without removing the first plug from the board.

681,878. TELEPHONE SWITCH APPARATUS; L. M. Ericsson, Stockholm, Sweden. App. filed March 29, 1899. Improvements in automatic switching apparatus.

681,918. MACHINE FOR LEADING SOUND RECORDS; E. R. Johnson, Philadelphia, Pa. App. filed Jan. 20, 1900. A machine for applying graphite to the grooved surface of phonograph cylinders, before the electro plating process.

681,932. TELEGRAPHIC RECORDING APPARATUS; J. F. Skirrow, East Orange, N. J. App. filed Jan. 25, 1901. An apparatus for recording messages on a moving paper strip by means of a series of recording instruments, each of which is in circuit with a telegraph instrument and is adapted to work in unison therewith.

681,933. TROLLEY; H. Smith, Watervliet, N. Y. App. filed Jan. 7, 1901. Details.

681,939. ELECTRICAL MUSICAL INSTRUMENT; R. L. Venuto, Kansas City, Mo. App. filed Aug. 7, 1900. Electric bells of the various tones are connected electrically with a keyboard.

681,943. ELECTRIC SWITCH; C. F. Zeigler, Chicago, Ill. App. filed May 4, 1901. Details of a rotary switch controlling a multiplicity of circuits.

681,951. SYSTEM OF ELECTRICAL INTERCOMMUNICATION; E. A. Clark, Sioux City, Iowa. App. filed June 8, 1896. Details.

681,965. APPARATUS FOR TRANSFORMING ALTERNATING INTO CONTINUOUS CURRENT; Maurice Hutin and Maurice Leblanc, of Paris, France. App. filed Jan. 5, 1900. (See Current News and Notes.)

681,981. TROLLEY ARM FOR ELECTRIC CARS; J. F. Snow, Pawtucket, R. I. App. filed Feb. 19, 1901. The trolley wheel is carried in a lever pivoted to the upper end of the arm and restrained by springs; the pivot is vertical to provide for lateral movement of the wheel.

681,982. COOKING UTENSIL; G. E. Savage, Meriden, Conn. App. filed March 5, 1901. A mechanical arrangement for securing a cooking utensil to an electric heater, whereby the parts will be detachably connected and yet cannot be accidentally separated.

681,992. FLASHER FOR ELECTRIC LAMPS; C. Slusser, Danville, Ill. App. filed April 15, 1901. A flashing device for electric lamps, comprising a thermostat arranged in the electric circuit and partially surrounding the lamp globe at irregular intervals of time.

681,999. ART OF TRANSMITTING BODIES BY MEANS OF ELECTRO-MAGNETS; J. P. Swift, Pawtucket, R. I. App. filed Sept. 10, 1900. The process of transmitting a body or bodies from one point to another, which consists in placing a movable magnet in proper relation to a second magnet, then energizing the first magnet to cause it to attract and hold said body till brought to said second magnet, and then energizing the second magnet and demagnetizing the first-named magnet.

682,007. ELECTRO-MAGNETIC APPARATUS; I. G. Waterman, Santa Barbara, Calif. App. filed April 19, 1901. An apparatus for controlling valves electro-magnetically.

682,030. SERIES TELEPHONE SYSTEM; C. A. Casperke, Brandenburg, Ky. App. filed April 17, 1901. In a series telephone system, a ringer-coil at each station and a condenser in multiple therewith, the said condenser being included in a shunt-circuit having no source of impedance therein.

682,056. CONTACT FOR UNDERGROUND TROLLEYS; J. S. Garousi, New York, N. Y. App. filed July 10, 1901. A contact frame having contacts on its ends freely slidable on the plow.

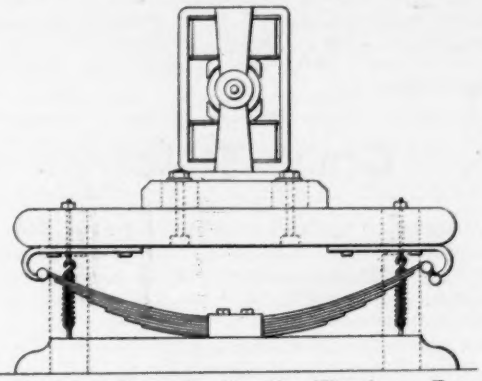
682,088. ELECTRIC FURNACE; F. A. Kjellin, Gysinge, Sweden. App. filed March 13, 1901. (See Current News and Notes.)

682,089. MEDICINAL ELECTRODE; O. L. Leach, Providence, R. I. App. filed June 6, 1901. A tubular conductor having an enlarged end containing spongy material and adapted to be applied to different parts of the body.

682,093. CONTROL OF ALTERNATING-CURRENT MOTORS; Reni Dassy de Lignieres, of Paris, France. App. filed March 22, 1901. (See Current News and Notes.)

682,101. ARC LAMP; J. C. Mayrhofer, New York, N. Y. App. filed July 27, 1898. Details.

682,104. BASE FRAME FOR ABSORBING VIBRATION OR TREMOR; G. Middleton, London, Eng. App. filed May 13, 1901. The base frame of a motor or dynamo is supported on springs.



682,104.—Base Frame for Absorbing Vibration or Tremor.

682,108. TIME REGULATOR FOR ELECTRIC MOTORS; M. M. Movshovitch, New York, N. Y. App. filed March 19, 1901. A time regulator for an electric motor, comprising a shaft having gear connection with the motor, a cylinder mounted on said shaft but insulated therefrom, said cylinder consisting of two compartments communicating one with the other, a liquid in the cylinder, and floats in the compartments for closing the electric circuit.

682,114. ROSETTE; H. T. Paiste, Philadelphia, Pa. App. filed Oct. 20, 1900. Details.

682,116. ELECTRIC LIGHT ATTACHMENT; J. H. Rusby, Nutley, N. J. App. filed Oct. 20, 1900. Details.

682,122. FUSE BOX; E. A. Wilson, Niles, Ohio. App. filed Sept. 11, 1900. Details.

682,142. MEANS FOR COILING FLEXIBLE MATERIAL; E. R. Gill, New York, N. Y. App. filed March 28, 1899. In a means for coiling flexible material, a divisible rotatable outer carrier adapted to loosely surround the device to be wound upon, a divisible inner carrier borne loosely thereon, and means for rotating one of said carriers.

682,152. TELEPHONE EXCHANGE APPARATUS; A. B. Stetson, Malden, Mass. App. filed May 24, 1901. To prevent the clicks in the receiving telephone, caused by the various connections by central office, the switch board cord and its ringing key are provided with means for preventing the discharge current from acting upon the repeating induction coil, by diverting the discharge through an alternative channel of lesser resistance.

682,155. ELECTROLYTIC APPARATUS FOR EXTRACTING PRECIOUS METALS; C. P. Tatro and G. Delius, Seattle, Wash. App. filed Jan. 15, 1901. (See Current News and Notes.)

11,930. (Reissue.) ELECTRIC ARC LAMP; D. Higham, Winthrop Highlands, Mass. App. filed July 20, 1901. (See Current News and Notes.)